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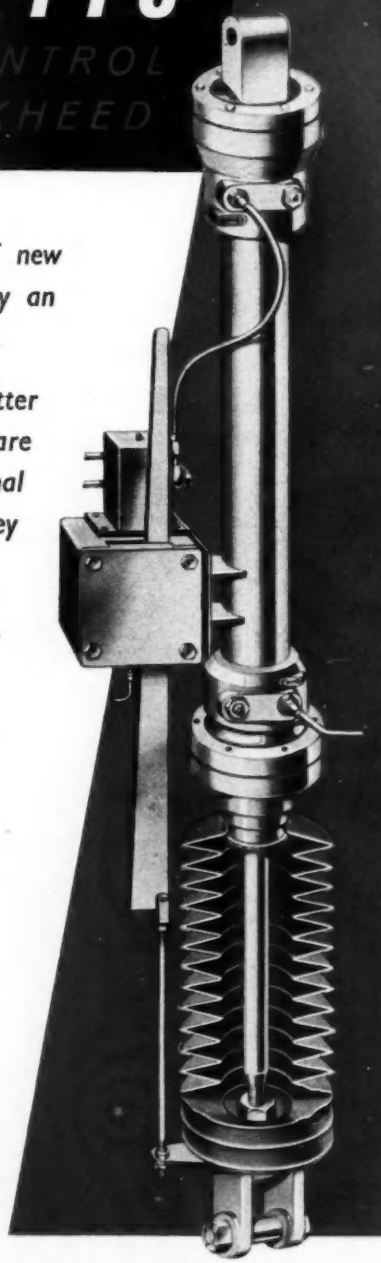

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Engineering and BOILER HOUSE REVIEW

THE OLDEST ESTABLISHED STEAM ENGINEERING PUBLICATION

OCTOBER 1961

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The Editor will be glad to receive and consider original contributions, correspondence, etc., of a suitable nature for publication. Stamped and addressed envelopes should be enclosed for the return of any matter considered unsuitable

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These boilers, of which 12 are BABCOCK units, will operate together with evaporatively-cooled furnace door-frames and skid bars (supplied by Spencer-Bonecourt-Clarkson Ltd.) to supplement the steam supply from the main works power-station boilers, which also are Babcock units.

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Eight **Babcock 'marine' header-type waste-heat boilers** serving 8 *soaking pits;* each to supply up to 9,760 lb./hr.

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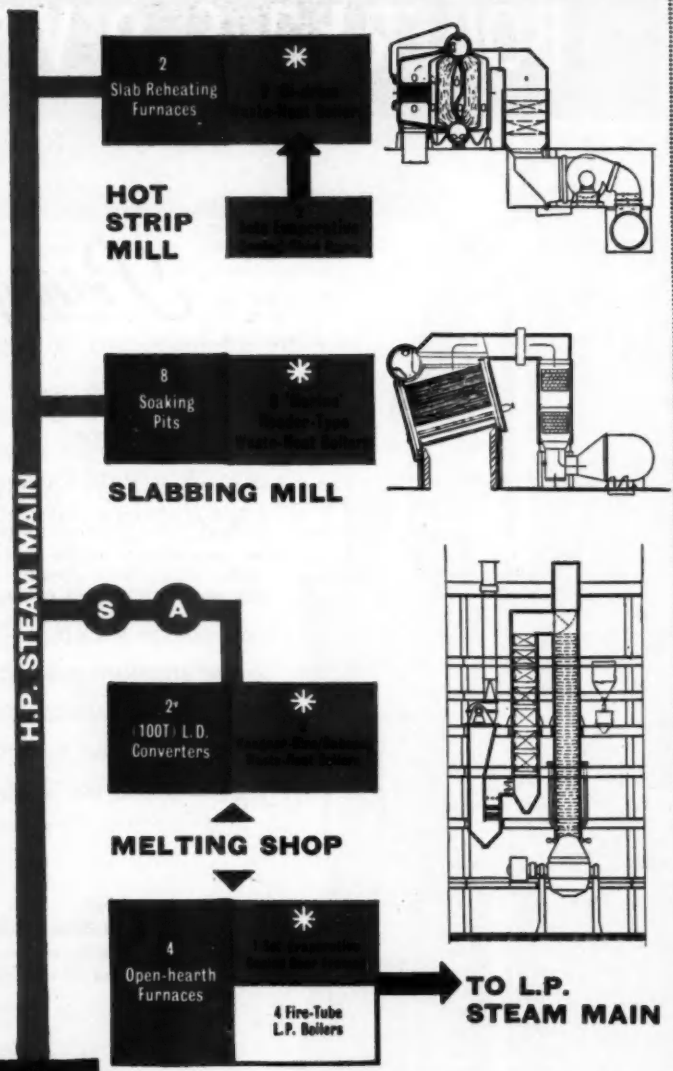
Modern industry is *using* its waste heat to cut costs, with Babcock plant and experience.

The main boilers in the power station, comprising four Babcock Bi-drum units, each with an evaporation of 125,000 lb. steam/hr. supply high-pressure steam (at 425 lb./sq. in., 820° F.) for electrical power generation and the operation of turbo-blowers serving the blast furnaces. Provision is also made to supply steam for process purposes. Main fuel is blast-furnace gas with a G.C.V. of approximately 98 B.Th.U/cu. ft., at a pressure of 10 in.w.g. Oil burners are also provided for auxiliary or alternative oil-firing and provision made for future stoker-firing with coke-breeze from the works' coke-ovens.



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Engineering and BOILER HOUSE REVIEW

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CONDITIONS IN FOUNDRIES

FOUNDRIES may not be examples of places where the more healthy and pleasant working conditions prevail, although sometimes the descriptions and criticisms directed to them are often overdone. At the same time, there is, of course, plenty of scope for general improvement in many foundries large and small. It will be appreciated that there are two main aspects of the problem of improving general conditions in foundries—the technological and psychological. A good deal of work has been done on this important problem and a certain degree of success has been achieved. Details of the work done in one section of the foundry industry are given in a recently published report—" Conditions in Steel Foundries " (published by H.M. Stationery Office, price 10s.). Upon examining the report, we find that, as its title indicates, it is mainly concerned with steel foundries. Nevertheless, many of its findings apply equally to other types of foundry, and even to some completely different industrial concerns.

It is obvious that one of the major problems in foundries of all types is the elimination, or at least the control, of dust and fumes, both of which can be and very often are, a nuisance and a danger to the health of foundry workers. Much effort has been devoted to the problems of both the reduction and the control of this hazard. The report is the first to be issued by the Joint Standing Committee on Conditions in Steel Foundries. Set up in 1952, this Committee continued the work of the Committee on Dust in Steel Foundries, which was appointed in 1943, and whose work was reported twice, in 1944 and 1951, indicating on the latter occasion that there was still much work to be done. The present report details the work done by the committee during the last seven years, and emphasises the fact that, although useful information has been collected, it should be given the widest possible publicity, and that the preventive measures devised, should be put into practice in the industry at once.

Although a large part of the work of the committee has been on the prevention of industrial diseases in steel foundries by dust and fume elimination, separation or control, a considerable amount of attention has been paid to accident prevention. From an examination of the industry's accident statistics during the period 1953 to 1956, the committee concluded that a determined attack on the principal causes of accident could bring about a very substantial reduction. The committee recommends, in particular, a higher standard of what they refer to as " House-keeping," which includes the provision of better floors and gangways; wider provision of protective clothing and equipment and the necessary corollary—its proper use by work-people; good first-aid services; and better training and instruction in safe methods.

For such efforts to be successful, there must obviously be keen interest and determination by both management and workers, and the committee feels that there is room for considerable improvement in this connection. So many of the things which could be done to improve conditions are simple and inexpensive that it is often difficult to see why they are neglected. It is also unfortunately the case, that a simple and effective precaution is put into practice and then forgotten. An effective dust-extraction system soon becomes a costly absurdity if the filters are choked, dirty or broken.

Deliberate misuse of equipment designed for everybody's good merits enquiry, and if it is found to arise from malice or even from prejudice, may require to be met by strong measures. Where there is equality of hazard, there must be seen to be equality of precaution. In order to improve conditions, a useful start can be made by the establishment of a safety committee, with equal representation from management and men. Such bodies exist in many works, but the committee is of the opinion that some of the safety organisations could do with rejuvenation, and that there is much new ground to be broken.

Points and Pointers

NEW C.E.G.B. RESEARCH AND DEVELOPMENT LABORATORIES IN NORTH WEST REGION

New research and development laboratories were opened on September 8th in the North Western Region of the Central Electricity Generating Board by Mr. Leonard Rotherham, M.Sc., F.Inst.P., F.I.M., Board Member for Research. Addressing an audience of some two hundred, Mr. Rotherham said that the laboratory has a special place in the national picture as well as in the regional. For example, they expect much of the work on welding will be done in the North Western Region. Similarly at Lake Trawsfynydd, they have a unique opportunity to study cooling in a mass of water moving slowly. It is the intention of the board to conduct a major experiment at Trawsfynydd on this particular subject. The new laboratories, in general, will be responsible for research studies which will lead to improved efficiency and availability of plant within the North Western Region. They occupy a new wing attached to the headquarters at Central Electricity House, Wilmslow Road, East Didsbury, Manchester, and will be known as the Research and Development Department. Head of the new department is Mr J. Harvey, B.Sc., F.R.I.C., Regional and Research Development Officer. Mr. Rotherham, in his speech at the opening ceremony, pointed out that research and development within the electricity supply industry, carried out in laboratories associated with headquarters organisation of the board is now augmented, under regional management, by research and development departments in each of the five regions into which the board's operations are divided. In the North Western Region, the major effort will be in the fields of Chemistry, Physics, Metallurgical and Electrical (light current) Engineering, and provision is made in the new laboratories for these sections and for an associated workshop. At Didsbury, the department is conveniently placed to use the library facilities of Manchester, while the ties which already exist between the Generating Board and Manchester University will, it is hoped, be further strengthened.

MECHANICAL ENGINEERING CONFERENCES

A number of conferences has been organised by the Institution of Mechanical Engineers, Birdcage Walk, London, S.W.1. An International conference held jointly with the A.S.M.E. on "International Developments in Heat Transfer" was held in Boulder, Colorado, from August 28th to September 1st, and is to be repeated from January 8th to 12th next year. One hundred and twenty-four papers are included in the proceedings, under the following classifications: "Heat Conduction and Thermo-Electric Effects"; "Heat Transfer in Equipment"; "Boiling and Burnout Condensation and Two-phase Flow"; "High-speed Flows, Aspects of External Convection, Vibrations and Pulsating Flows"; "Internal and Duct Flow"; "Mass Transfer, Packed and Fluidised Beds"; "Radiation Thermal Properties and Instrumentation," and "Free Convection." Four special lectures were presented during the Boulder Conference: Professor Owen A. Saunders, City and Guilds College, London, immediate past-president of the Institution, delivered a Calvin Rice lecture: "Some Reflection on Progress in Engineering Heat Transfer Science"; Dr. E. R. G. Eckert, University of Minnesota, lectured on "Research during the last decade on Forced Convection Heat Transfer"; Dr. E. A. Schmidt, Munich, spoke on "Heat Transfer by Natural Convection"; while Dr. H. C. Hottel, Massachusetts Institute of Technology, lectured on "Problems of Radiative Transport." It is intended to arrange for the re-presentation of these lectures at the London Conference. The Hydraulic Plant and Machinery Group of the Institution is holding a conference at the Institution on November 29th and 30th on "Oil Hydraulic Power Transmission and Control." Twenty papers will be presented, and visits to works manufacturing hydraulic equipment are involved. The provisional allocation of subjects is as follows: "Pumps and Motors" (two papers); "Transmissions" (five papers); "Servos and Controls" (four papers); "Applications" (five papers); and seven miscellaneous papers.

INSTITUTION OF PLANT ENGINEERS—SCOTTISH REFRESHER COURSE

The Institution of Plant Engineers announces that the next of its comprehensive Refresher Courses for Works and Plant Engineers is to be held in Scotland this winter, at the Institution of Engineers and Shipbuilders, Elmbank Crescent, Glasgow. Sponsored by Sir Andrew McCance, D.Sc., Ll.D., F.R.S. (chairman of Colville's Ltd., and chairman of the Board of Governors of the Royal College of Science and Technology), and available to all engineers who wish to take advantage of it, the course comprises 18 weekly lectures on Wednesday evenings, commencing on November 1st. The syllabus covers a wide range of subjects conducted by specialists drawn in the main from industry and includes: The Pro's and Con's of Systematic Control and Planning in the Engineering Department; The Value of New Materials and Techniques in the Solution of Engineering Problems; Some Current Techniques and Future Trends in the Planning of Plants and their Subsequent Operation; The Impact of Automation on the Plant Engineer; Cost Consciousness and the Engineer; Combustion and Steam-Raising Oil-firing; Steam Utilisation; Space Heating; Thermal Insulation of Industrial Buildings; Electrical Systems in Factories; Materials Handling; Properties and Treatment of Metals and Alloys; Developments in Welding Practice; and Management in Plant Engineering. Designed to

encourage the most effective use of existing knowledge and to promote the application of up-to-date techniques in works engineering practice over a broad field, the purpose of the course is, as Sir Andrew McCance points out in his introductory letter to industrial managements, to help works and plant engineers to make the fullest possible contribution to increasing productivity. The fee for the course, is four guineas, and copies of the syllabus and full particulars may be obtained from the secretary of the Refresher Course, 39 Elmbank Crescent, Glasgow C.2. This is the latest of the series of major refresher courses organised by the Institution at various centres in Britain. It represents the return visit to Glasgow where, in 1953, industrial managements within a 50 miles radius enrolled 405 works and plant engineers for the course.

NUCLEAR ELECTRONICS SYMPOSIUM

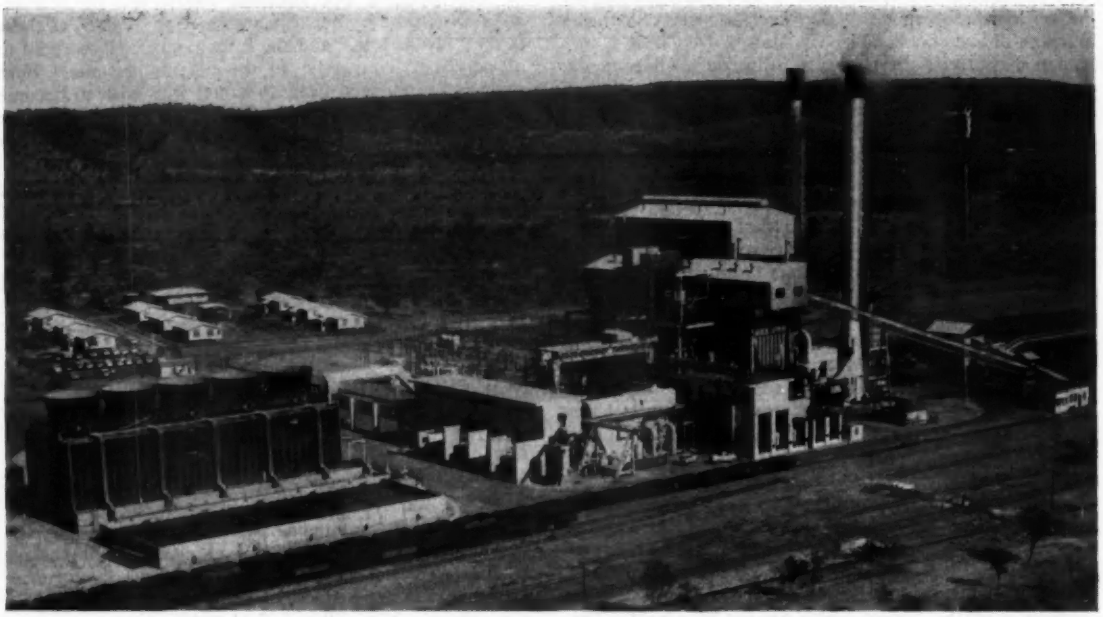
The Measurement and Control Section of The Institution of Electrical Engineers is arranging a Symposium on Nuclear Electronics to take place on November 30th and December 1st next at Savoy Place, London, W.C.2., which is intended to follow up the conference on the same subject held by the International Atomic Energy Agency in Belgrade in May of this year. The Belgrade Conference was attended by delegates from more than 30 countries, and is considered to have been the largest and most successful international conference on the subject which has yet been held. The symposium which the Institution is now arranging, after consultation with the International Atomic Energy Agency, is intended to give an opportunity for those interested in the subject in this country, and particularly for those who did not attend the Belgrade Conference, to hear and discuss reports on the material presented there. The symposium will consist of three sessions, dealing respectively with "Radiation Detectors," "Electronic Circuits and Techniques" and "Radiation Monitors and Instruments." At each session, a report on the subject matter of the relevant papers presented at Belgrade will be given, after which, other speakers will either deal in more detail with subjects which they themselves presented there, or give their own appraisal of the impact of the Belgrade Conference on current researches in this country. At the end of each session there will be an opportunity for the discussion of all the material presented. Registration forms for the symposium can be obtained from the Secretary, The Institution of Electrical Engineers, Savoy Place, London, W.C.2. The registration fee (to be sent with the registration form) is £1 for members of The Institution of Electrical Engineers and £1 10s. for non-members of the Institution. All registrants will receive a set of abstracts of the material to be presented.

ELECTRICITY SUPPLY INDUSTRY SCHOLARSHIPS

In order to enable the rapidly-expanding Electricity Supply Industry to meet its future requirements for top level scientists and engineers, the industry is currently offering 61 university scholarships to outstanding school leavers. The scholarships provide for the payment of all tuition and other university fees (which may amount to £100 or more per annum), plus a maintenance grant of £375 a year at Oxford and Cambridge, £360 a year at London, and £330 a year at other universities. These rates are well above the level of corresponding local authority awards and the scholarships should be particularly attractive to parents, as there is no "means test," and the full amounts will be paid to all scholars, irrespective of the parents' income. Both boys and girls, aged from 17 to 21, who wish to become scientists or engineers, are eligible to apply. Thirty-six scholarships, all in electrical engineering, are offered by the combined 12 Area Electricity Boards and 25 scholarships, in a wide range of science and engineering subjects, by the Central Electricity Generating Board. Details of the scheme, and application forms, have been sent to grammar and public schools throughout the country by the Electricity Council. In the three years since the scheme was launched, more than 150 scholarships have been awarded. Last year 67 awards were made—three of them were to girls.

NEW ENGINEERING & BUILDING CENTRE FOR BIRMINGHAM

A new "shop window" for Britain's engineering and building trades is to be opened on one of the most important sites in Birmingham early next year. The £200,000 former Masonic Temple, in the heart of the city's civic and commercial community—Broad Street—is now being converted into a unique and comprehensive exhibition hall. Rooms are being re-styled, entrances and staircases are being remodelled in a £80,000 alteration scheme which will turn the building into a centenary-year new headquarters for the Engineering and Building Centre, Birmingham. The new centre is, in fact, a direct descendant from the city's Iron and Coal Exchange which was founded in 1861 and flourished for about 80 years. Its place was ultimately taken by the Birmingham Exchange and Engineering Centre in Stephenson Place which is to remove and link with the building trade on the new project. In a setting of modern planning and decor—from the panoramic effect created by an entirely new method of stand layout, to the rear extension on stilts—some of the country's finest products will be on show in a permanent, yet ever-changing exhibition of interest to the technically-minded, and to those responsible for specifying products and materials. Almost everything from door-knobs to tool steels and turbines will be on show in the 37,000 sq. ft. building which will also provide facilities for special short-term exhibitions in two smaller halls. In addition, there will be reading, writing and refreshment rooms, secretarial services, private lockers for exhibitors, lecture halls, projection equipment, a catalogue library and a full information service for visitors to discuss, without any obligation, any aspect of business from finding work contracts to locating the manufacturer of specific items. The value of a centre of this kind to the country as a whole is inestimable. More than 10,000 inquiries a year are being handled at the Stephenson Place premises and in excess of 4,000 serious inquiries have been received at recent overseas Trade Fairs in which the Centre has organised group displays. From September 14th, exhibitors are being invited to book space in the new Centre which has provision for about 600 displays, and leaflets are being sent to firms in all parts of the country informing them of the style of things to come, and emphasising that this is a British "show" and not only confined to the Midlands.



Mica Creek Power Station—Queensland

THE new Mica Creek Power Station, being built by Mount Isa Mines Limited, Queensland, at a cost of approximately £6 million, is the first power station of its type to be built in Australia and perhaps the first in the Southern Hemisphere, with the plant of semi-outdoor construction—that is, erected "in the open" with neither conventional boiler nor turbine houses, protective housing only being provided where necessary for the control equipment and suchlike. Furthermore, it is the largest power station in Australia to be built by private enterprise.

Mount Isa Mines Limited are engaged in the mining of copper, lead, silver and zinc, and the construction of the new power station forms part of a vast expansion programme (estimated to cost £30 million) which is aimed at achieving a daily treatment of 14,000 tons of ore by next year, for the production of the above-mentioned minerals. The object is to treble mineral production within a period of five years. Copper concentrates surplus to the requirements of the Townsville Refinery are exported.

Besides supplying the power needs of the Mount Isa Mines' expanding plant, the new Mica Creek Station will ensure adequate power supplies for the town of Mount Isa, some four miles away. The site is approximately 200 miles south of the Gulf of Carpentaria, and 600 miles by rail from the deep-water port of Townsville. The £30 million railway rehabilitation scheme, undertaken by the Queensland Government, allows for rapid and direct transport from the Mount Isa site to the port. A transmission line, estimated to cost £300,000, is being extended 72 miles to the town of Cloncurry, in order to provide that neighbourhood with industrial and domestic power supplies. The railway scheme also entailed reconstruction of the existing line from Townsville to Collinsville, to enable increased deliveries of coke from the Bowen coalfield for the mining treatment plant.

The history of power supply to the mine may be divided into several phases, as follows:—

(1) The supply of lighting and power during the first plant construction period 1929-1931.

(2) The construction of the first section of the Mines Power Station, comprising Nos. 1 and 2 turbo-alternators and boilers.

(3) The addition of No. 3 turbo alternator and boiler.

(4) The addition of No. 4 turbo alternator and boiler.

(5) The addition of No. 5 boiler.

(6) The addition of:

(a) Two turbo-blowers for air supply to the copper smelter converters.

(b) One turbo-blower for air supply to the lead smelter.

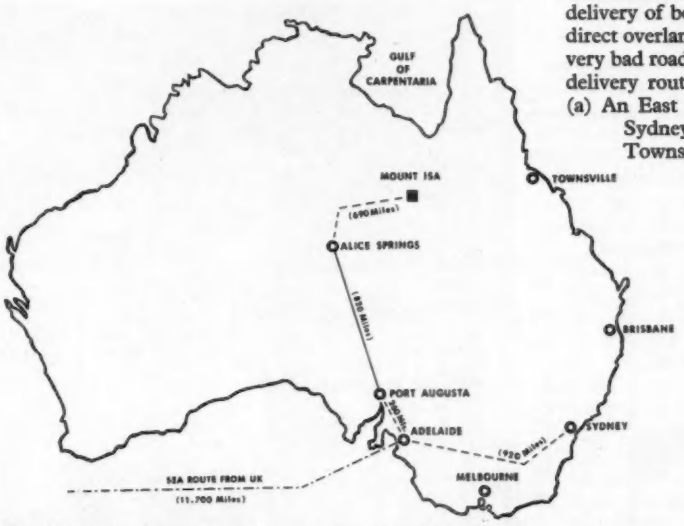
(c) Two turbo-compressors for compressed-air supply to the mine and surface plant.

(7) The construction of a completely new station at Mica Creek, together with the necessary transmission system.

To these items may be added the installation of two waste-heat boilers attached to the copper smelter reverberatory furnace. These boilers, although not part of the Mines Power Station, supply steam to the station

receivers and thus have an effect on power production.

As previously mentioned, the power plant is of outdoor construction, and although numerous plants in other parts of the world are constructed with the boiler plant in the open, this is one of the few stations in which the turbo-alternator plant is also installed without a conventional turbine house. A walk-in enclosure is provided at the steam and exciter ends of the turbine, while the air-conditioned control room, switch room, amenities block and workshop are the only fully-enclosed constructions. The decision to build a so-called " outdoor " station was based, of course, on suitability of climate, and the capital saving resulting from this type of arrangement.



The first section of the station is now in operation and consists of one 280,000 lb./hr. pulverised-coal-fired boiler and one 30-MW turbo-alternator set, together with the necessary auxiliary equipment. The switchgear compound and transmission lines to the mine are complete, as are the coal and ash-handling plants and circulating-water system. The second section of the station, which is now approaching completion, consists of a similar boiler and a similar turbo-alternator set. This provides a total installed generating capacity of 60-MW.

Coal, the most economic fuel for the boiler furnaces, is transported nearly 800 miles by rail from the Scottville district where the company has a recently-developed colliery, while water is supplied through a 12 in. dia. pipeline from the Rifle Creek Dam, 16 miles south of the station. An alternative supply is available, however, from the Leichhardt Dam.

The cost of the power station alone is £5·25 million. This represents approximately £88 per kW installed. The transmission and distribution system and the two switchgear compounds add a further £1 million to the total. It is anticipated that additional plant to the value of £450,000 will be installed during the next four years. Throughout the design and layout of the plant, provision has been made for the expansion of the station to allow for the installation of five boilers and four generating sets, with a total installed generating capacity of 120-MW. The normal personnel required for the operation of the station will be about 60. This includes maintenance and coal-handling personnel, and six operators per eight-hour shift.

The two boiler units at present installed were supplied by Babcock and Wilcox of Australia (Pty.) Ltd., and the two 30-MW turbo-alternator sets by the British General Electric Co. (Pty.) Ltd., Sydney. In view of the remote location of the power station site, the transport of plant and material thereto presented quite a number of problems. The boiler plant manufactured in Sydney was transported about 2,700 miles by land to Mica Creek. This distance is thought to be a record for the overland delivery of boiler plant and equipment. A comparatively direct overland route was ruled out at the start, because of very bad roads which are subject to flash floodings. Three delivery routes were therefore considered, as follows:—

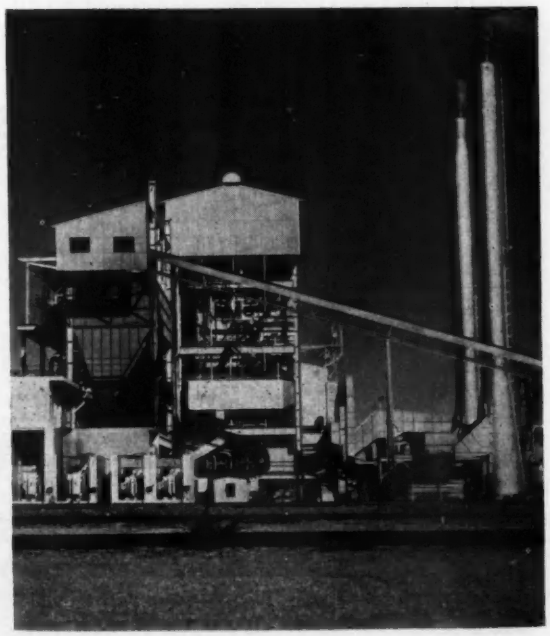
(a) An East Coast sea and rail route:—

Sydney to Townsville by sea	..	1,100 miles
Townsville to Mount Isa by rail	..	600 ,,
Total		1,700 ,,

(b) An East Coast rail route:—

Sydney to Brisbane	615 miles
Brisbane to Mount Isa, via Townsville	1,420 ,,
Total	2,035 ,,

Fig. 1. Outline map showing the two main routes that were adopted for transporting the Australian material and the material imported from the United Kingdom. Fig. 2 (below). Side view of " outdoor " boiler plant installation.



(c) A road, rail and road route via Adelaide:—

Sydney to Port Augusta, via Adelaide, by road	1,180	miles
Port Augusta to Alice Springs by rail	820	,,
Alice Springs to Mount Isa by road	690	,,
Total	2,690	,,

Route (c) was chosen for economic reasons and for the advantages offered from the handling point of view. Components could be despatched more conveniently from sub-contractors' works having no rail sidings, and so obviate extra hauling on various wharfs. Final delivery could be made direct over the four miles from Mount Isa to the power station site. Also, it enabled many loads of a more fragile nature, such as alloy piping and instrument panels, to be sent pick-a-back on the rail haul from Port Augusta to Alice Springs in order to minimise the risk of damage.

Some of the heavier boiler components which were made at the Babcock Works at Renfrew, Scotland, were shipped to Adelaide (11,700 miles from the United Kingdom), sent by road to Port Augusta (820 miles), and then by road to Mount Isa (690 miles). This gives a total of 1,770 miles in Australia, plus the mileage by sea to Adelaide from the United Kingdom, and making a total journey of 13,470 miles. This route was some 1,500 miles less than the alternative route from Adelaide by sea to Townsville, and on by rail to Mount Isa; it proved both cheaper and quicker and, furthermore, reduced considerably the risk of delays. However, Babcock and Wilcox of Australia (Pty.) Limited have had considerable experience of long-distance road transport, having employed this method some six years ago as an emergency measure for delivering two 20-ton pressure-vessels from Sydney to Western Australia, over the then-unusual route of 2,200 miles across the continent.

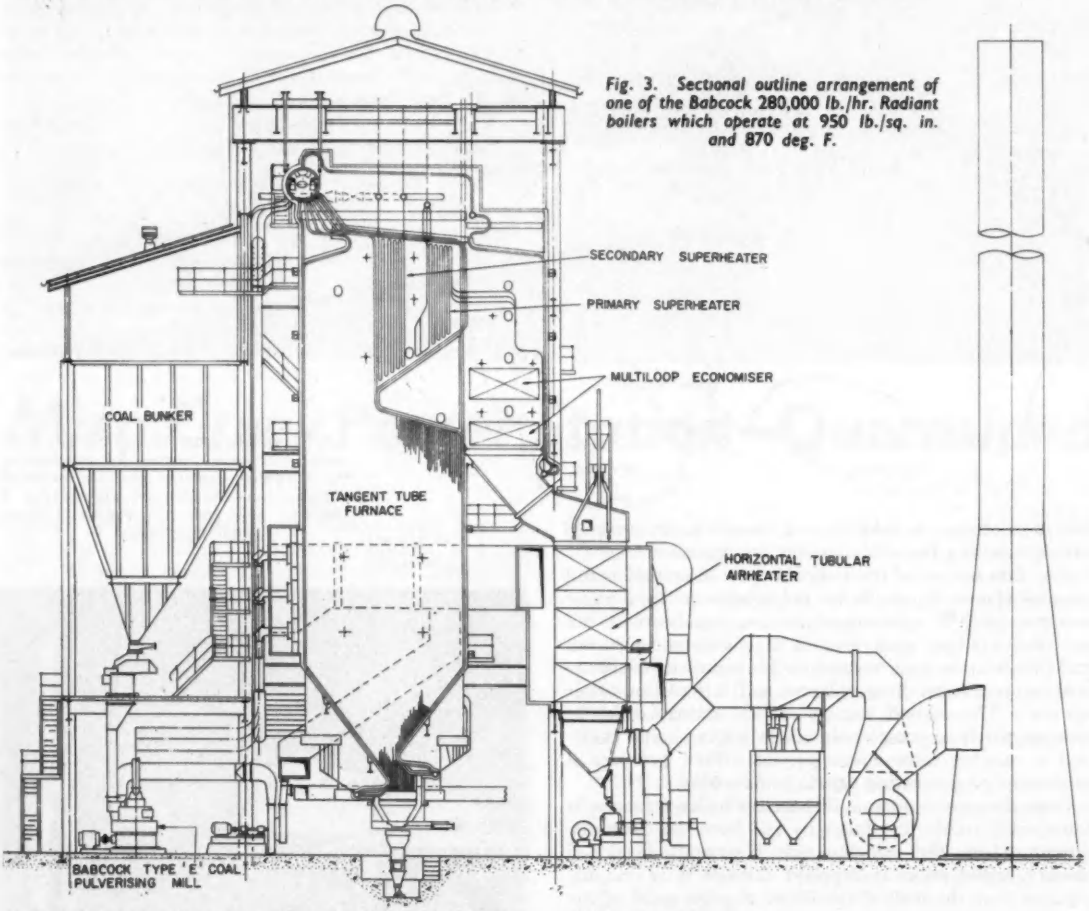


Fig. 3. Sectional outline arrangement of one of the Babcock 280,000 lb./hr. Radiant boilers which operate at 950 lb./sq. in. and 870 deg. F.

Boiler plant

The two pulverised-fuel-fired Radiant boilers were supplied by Babcock and Wilcox of Australia (Pty.) Limited, who were responsible for much of the manufacture at their Regency Park Works, Sydney, and also for erection on site. Incidentally, the Babcock Company had previously supplied six boiler units to the Mount Isa Company. These included (in 1928) two C.T.M. type boilers, each of 62,500 lb./hr. capacity, pulverised-fuel-fired, and with steam conditions of 270 lb./sq. in. and 750 deg. F. at the superheater outlet. In 1935, another and similar boiler was installed, while in 1947, a 100,000 lb./hr. C.T.M. type unit with outlet steam conditions

similar to the previous boilers was supplied. Two years later (1949), two Integral Furnace Waste-Heat boilers were supplied, design steam conditions being 350 lb./sq. in. and 750 deg. F. The two new boilers are each of 280,000 lb./hr. capacity, with steam conditions at the superheater outlet of 950 lb./sq. in. and 870 deg. F. Each boiler is supplied with three Babcock Type E.38 pulverising mills, each mill supplying two p.f. burners.

The mills are designed to grind coal from Bowen Consolidated Coal Mines Ltd. Scotville mine to 80 per cent. minus 200 mesh. Coal is stored in 700-ton capacity bunkers above the firing-floor level, and passes through Simon weighers to the mills.

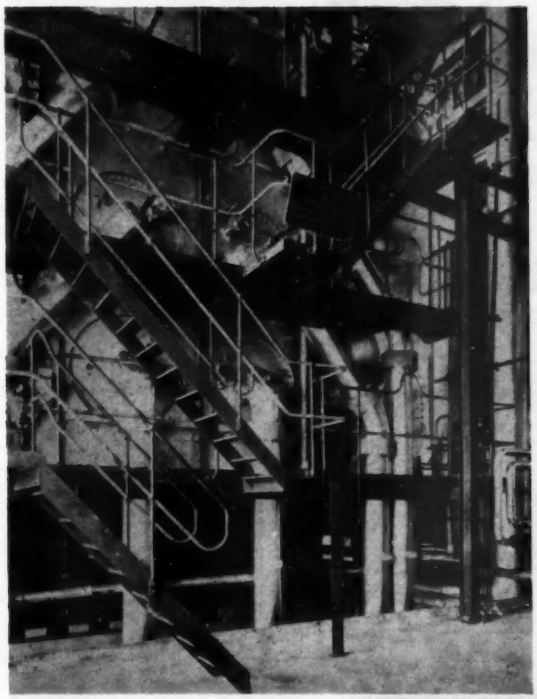


Fig. 4 (above). Front view of boiler showing the six p.f. burners which are of the horizontal circular type.

Each unit is provided with primary and secondary pendant-type superheaters and Babcock economisers and tubular type air-heaters, and also "Sirocco" grit-collectors supplied by Davidson & Co. Ltd., Belfast, who also supplied the complete draught plant, which, for the two boilers, comprises four F.D. fans, which are 65½ in. dia. single-inlet, backward-aerofoil-bladed units, six 67 in. dia. single-inlet R.B.6 primary-air fans, and four 86¾ in. dia. single-inlet, backward aerofoil bladed I.D. fans.

The Davidson grit-collectors (one per boiler) are 119-cell S.F. units with motor-driven booster fans. There are, also, two Davidson 34¾ in. dia. single-inlet R.B.4 shot cleaning fans, motor-driven. Davidson & Co. Ltd. also supplied the two alternator cooling fans, which are 65½ in. dia. single-inlet, backward aerofoil bladed, motor-driven units.

The boilers are fitted with automatic combustion control equipment, designed and supplied by Bailey meters and Controls Ltd.

The I.D. and F.D. fans are driven through Vulcan-Sinclair scoop-control fluid couplings supplied by Fluidrive Engineering Co. Ltd. For regulating each of the I.D. fans, a size-32 fluid coupling (type SCR4) regulates from 572 down to 120 r.p.m., the SC driving motor being rated at 140 h.p. at 585 r.p.m. A size 26 SCR4 coupling is used for each F.D. fan, the motor being rated at 130 h.p. or 970 r.p.m., with variable speed regulation from 948 to 200 r.p.m.

Scoop-control fluid couplings are also provided for the p.f. mill exhauster fans; these being type SCR6 couplings giving speed regulation from 1,410 down to 300 r.p.m., the S.C. motors being rated at 30 h.p. or 1,450 r.p.m.

The boiler and turbine control panels together with associated instruments and controls were designed, manufactured, and commissioned by Bailey Meters and Controls (Australia) Pty. Limited. The panels, which are housed in an air-conditioned control room, provided

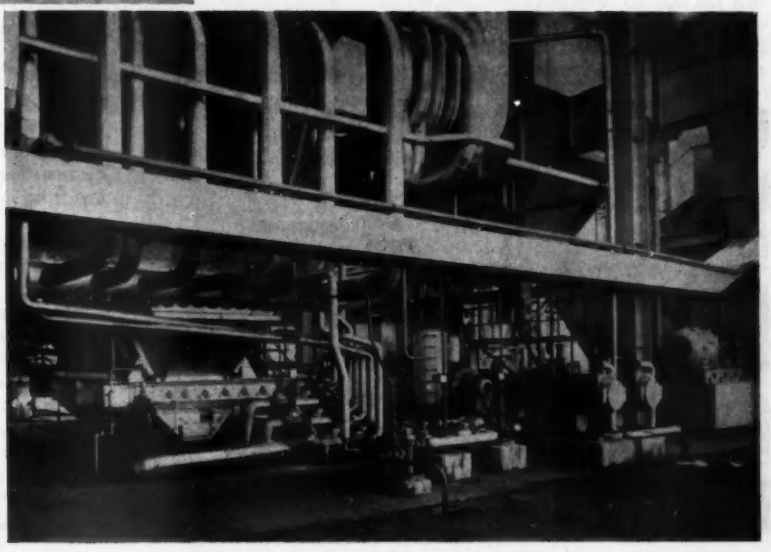


Fig. 5 (right). View at boiler house basement-level showing ash-hoppers and furnace water-wall supply pipes.

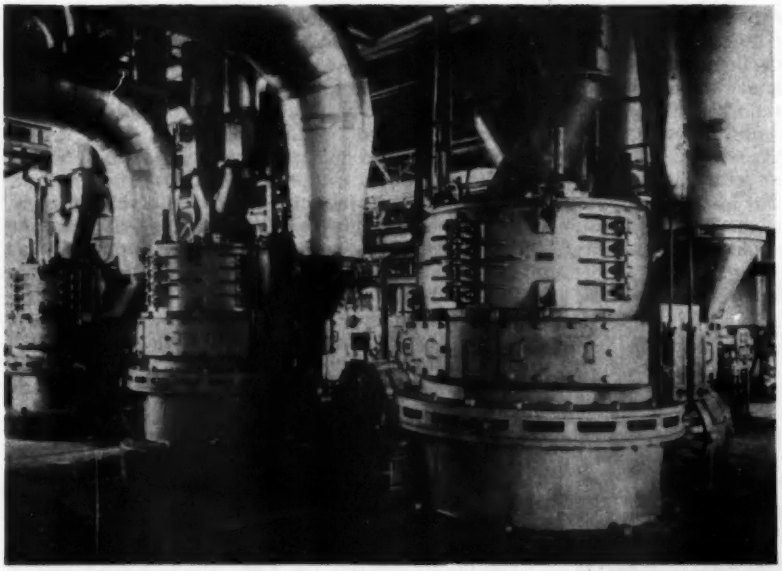
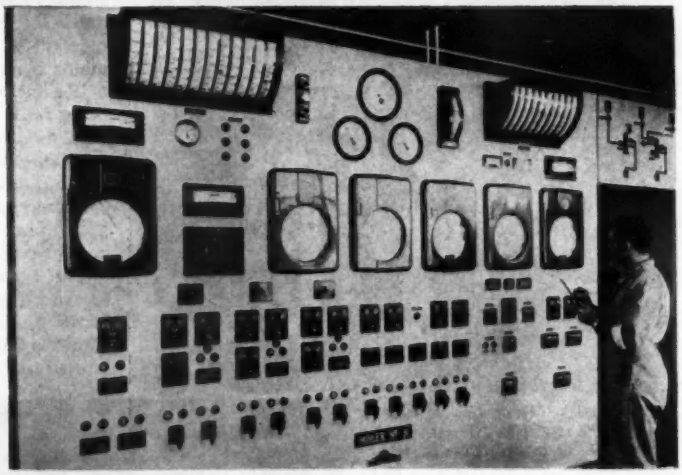


Fig. 6 (left). There are three Babcock type E38 p.f. mills for each boiler, each mill supplying two p.f. burners.

Fig. 7 (below). The boiler control panels, automatic control equipment and instrumentation was supplied by Bailey Meters & Controls (Australia) Pty. Ltd.



the necessary supervisory indicators and recorders, automatic and remote control stations, alarm indications and electrical auxiliaries control equipment. Boiler control is fully-automatic and designed to deal effectively with heavy traction steam load characteristic of mining machinery. Load control is effected from the steam pressure which regulates primary-air supply to the pulverisers, total air output from the forced-draught fans and output of induced-draught fans, the forced-draught being trimmed from steamflow-airflow ratio control for most efficient combustion conditions, while induced-draught is re-adjusted to maintain the desired suction in the combustion chamber. Fuel feed is automatically proportioned as a function of the primary-air flow to each pulverising mill and balanced in such a manner that the correct quantity of coal is being ground under all steam load conditions. Additionally, three-element feedwater control is included, operating from steamflow/waterflow ratio and drum water level. Steam temperature is automatically controlled by regulating the by-pass valve of a non-contact type attemperator.

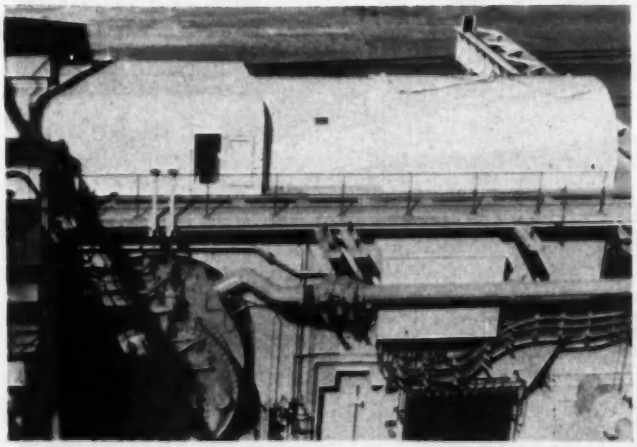


Fig. 8 (left). A general view of one of the two outdoor 30-MW G.E.C. turbo-alternator sets.

Water treatment plant

The water treatment plant was designed and manufactured jointly by The Permutit Company Limited, and The Permutit Company of Australia Pty. Ltd. It consists of a 6 ft. 6 in. dia. pressure-type sand-filter, followed by a 4 ft. dia. mixed-bed " Deminrolit " unit. The plant is capable of treating 60,000 gallons daily of

Rifle Creek Water. Raw water entering the plant is first dosed with coagulant to entrain suspended matter. The water is then passed down through the pressure-filter sand bed; this removes the suspended matter and produces a crystal-clear filtrate. The filtered water then passes to the mixed-bed "Deminrolit" unit. This is a rubber-lined steel vessel containing an intimately mixed bed of "Zeo-Karb" cation exchange resin and "De-Acidite" anion exchange resin. When water passes down through the bed, the dissolved salts in the water are removed, and the resulting demineralised water has a very high degree of purity.

Boiler feed pumps

The three boiler feed pumps, which were supplied by Sulzer Bros. (London) Ltd., are of that company's standard barrel-casing type arranged for centreline mounting, and each is designed to deliver 310,000 lb./hr. of feedwater, at a temperature of 228 deg. F. against a pressure of 1,255 lb./sq. in. Two of the pumps are direct-coupled to 3.3-kV, 680 b.h.p., 2,980 r.p.m. squirrel-cage induction motors arranged for direct-on-line switching, the third set being coupled to a G. & J. Weir impulse back-pressure steam turbine rated for an output of 710 b.h.p. at 4,450 r.p.m. The electrically-driven pumps are each provided with 11 stages, whilst the turbine-driven pump is a five-stage unit.

Turbo-alternator plant

The two turbo-alternator sets were manufactured by The General Electric Company of England and are single-casing 30-MW machines operating at 900 lb./sq. in., 850 deg. F. and exhausting to a vacuum of 27.8 in. Hg. The direct-coupled generators are rated at 0.8 p.f. 11-kV three-phase 50 c/s and are connected through transformers to the 132-kV substation. The turbine is a single-cylinder machine containing one double-row velocity wheel and 17 single-row stages. The glands are of the G.E.C. vernier labyrinth type of stainless material and machined from forgings. These give full freedom for differential axial movement without variation in efficiency. Fixed and moving blades are manufactured from stainless iron and steel. All moving and h.p. fixed blades are machined from solid material, the l.p. fixed blades being cast into the cast iron l.p. diaphragms. A number of automatic tripping devices are fitted; overspeed; solenoid; thrust wear; low oil presure; low vacuum and low oil-level and the usual electrical protective devices. The main lubricating oil pump is of the centrifugal type fitted to the turbine shaft.

The turbines are protected by walk-in metal weather covers with the exciter space pressurised to eliminate possible dust ingress during dust storms. During overhauls, the protection covers are replaced by maintenance covers. A "Goliath" type crane is provided for maintenance purposes.

The circulating-water is cooled in a five-cell double-flow 30,000 gal./min. forced-cooled tower of Marley Co.'s manufacture. The water is circulated by two 29,620 gal./min. horizontal split casing pumps supplied by Thompsons (Castlemaine) Ltd. Feed-heating is by means of one l.p. heater, a direct-contact deaerator and two h.p. heaters to 335 deg. F. final feed temperature. A 15,000 lb./hr. evaporator of Thompsons (Castlemaine) Ltd.'s manufacture is installed on one unit.

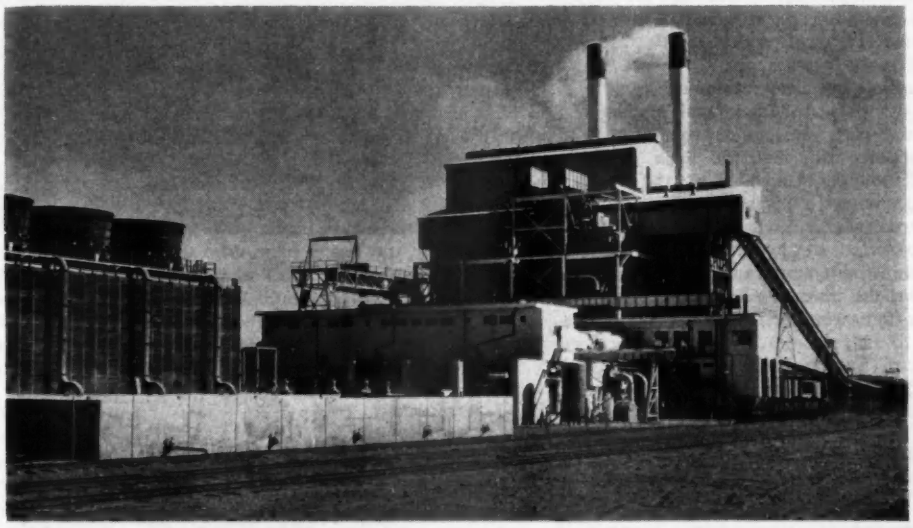


Fig. 9. Another general view of Mica Creek Power Station, showing part of the five-cell, double-flow cooling tower.

The two main transformers are rated at 35,000 kVA and manufactured by The General Electric Co. Ltd. The two 5,000 kVA auxiliary transformers were manufactured by the British General Electric Co. (Pty.) Ltd., as also were the two 1,000 kVA boiler house transformers, the two 500 kVA turbine house transformers, the two 500 kVA station transformers and one 500 kVA cooling-tower transformer.

Substation switching is by means of 12 G.E.C. 132-kV, 600 A, 1,500 MVA outdoor oil circuit-breakers and two 11-kV, 2,400 A, 350 MVA oil circuit-breakers. The 3,300 V switchgear comprises 25 cubicles of G.E.C. 400 A and 1,200 A, 150 MVA capacity air break circuit-breakers. The seven 440 V switchboards were made by the British G.E.C. (Pty.) Ltd.

Stress - relieving Operation at Hunterston

STRESS-RELIEVING of the first 70 ft. dia. reactor pressure-vessel at Hunterston nuclear generating station, Ayrshire, is reported to have been successfully completed by the General Electric Co. Ltd. The station is being built for the South of Scotland Electricity Board by the G.E.C. and Simon-Carves Atomic Energy Group. The construction of the pressure-vessels was sub-contracted out to the Motherwell Bridge & Engineering Co. Ltd. whose contract included the responsibility for the stress-relieving operation. Approximately 1,800 tons of steel, situated at a mean height of 85 ft. above ground level, was heated to a temperature of 288 deg. F., soaked for 12 hours, and then allowed to cool slowly. During the process, a high degree of control was essential to prevent the temperature difference between any two points in the vessel exceeding a certain specified maximum.

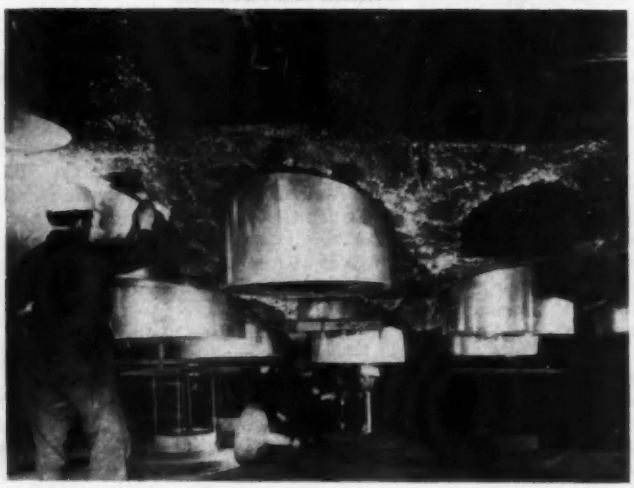
Installed inside the pressure-vessel, and undergoing stress-relieving at the same time, were the inner heat shield, the core-support grid, and the main gas seal between the walls of the inner heat shield and the pressure vessel. Certain portions of the hot and cold gas ducting and the nozzles for the charge/discharge and control-rod standpipes, which penetrate the pressure shell, were also included. The steel restraint beams for the graphite core were suspended from the inner shell nozzles, and other items treated at the same time were laid on top of the grid cover plate.

The electric heating system used was proposed and designed by the Industrial Advisory Service of the South of Scotland Electricity Board, who acted as consultants for the heating scheme to the Motherwell Bridge & Engineering Co. Ltd. throughout the job.

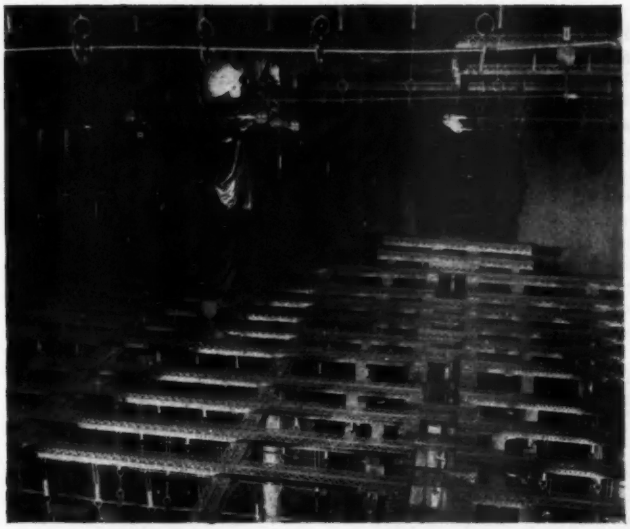
Because of the difficulty of achieving uniform heating by natural convection alone, it was felt that radiant heating should be adopted. The heaters were arranged in zones with external means of varying the heat output of the heater groups in each zone. To obtain the best possible heat transfer from the heaters to the fabricated structure, the heaters were free from insulation or sheaths. It was decided to employ heaters in the form of alloy strips. To achieve good electrical insulation characteristics the heater strips are widely spaced from earth and from each other. Considerable expansion of the whole heating system would take place at the high temperatures involved so that good clearance between live sections was a prerequisite. The pressure vessel and included components were, therefore, heated by a series of freely-radiating Brightray strips supported by wire links and ceramic insulators.

With the system of heater suspension employed, a curtain-like structure of heater elements was built up in the space between the inner heat shield and the pressure vessel. Brightray heater strips were also placed underneath the grid to ensure that this would be adequately heated. Enclosed tubular-type heaters were employed for each of the gas ducts. The method of suspension adopted was extremely flexible, and permitted the switching off of one heater without fear of any possible damage to the suspension of neighbouring heaters.

(Right). Rocksil thermal insulation material, supplied by Cape Insulation and Asbestos Products Limited, being applied to the bottom crown of the first reactor pressure-vessel, and (below) the charge nozzles being covered by a thin aluminium container.



It was considered necessary to divide the fabricated structure into 40 separate heating zones. By choosing suitably dimensioned heating strip it was possible to use 100-ft. lengths connected directly across the 240 V mains. This length of strip was chosen because it was half the circumference of the spherical pressure vessel, enabling the supply to be brought in at one side of the vessel and the neutral connection to be taken out of the other side.



Installing the electric heating strips under the grid of the reactor. The slotted-angle framework supports the heaters for the bottom crown.

Each duct heater was 8 in. dia. by 6 ft. long, with a rating of 24 kW at 240 V, and of stainless-steel construction. Two heating units were used in each hot gas duct, and one heating unit was employed in each of the shorter cold gas ducts.

Thermocouples

Temperatures were measured at some 400 points by means of chromel-alumel thermocouples. All the internal and external positions for the permanent thermocouples were used and, in addition, a number of temporary points were selected. The readings from these thermocouples were recorded by two different instrumentation systems. Particular attention was paid to the positioning of thermocouples on the pressure-vessel support skirt, gas-duct stubs, and sphere. It was possible to record the temperature distribution down the support skirt in various planes around its periphery. This enabled a check to be made on the performance of the thermal pocket at the top of the skirt. The temperature along each gas-duct was measured at several points to ensure that no large temperature gradients occurred. In addition, four pairs of thermocouples were connected differentially to record any temperature variation between selected points at the top and bottom of the large irregular-sectioned forgings at the duct roots. A pair of thermocouples, one connected to the top crown and the other connected to the bottom crown, were arranged to indicate the temperature difference between the two points, thus enabling the controller to regulate the heat input and thereby allow for the maintenance of an even temperature distribution throughout the pressure-vessel.

The vessel could be symmetrically divided into four quadrants, and it was fairly reasonable to assume that the heating pattern would be similar in each quadrant. Thus it was decided to connect strip-chart recorders to the thermocouples in the other quadrants. In addition to the thermocouples used for the pressure vessel and its contents, about 20 were placed in the surface of the concrete biological shield at the equator level, on the concrete beams forming the soffit, and in the concrete supporting the reactor skirt, to ensure that the rise in concrete temperature was not excessive.

Instrumentation

In order to eliminate the fatigue and consequent inaccuracy arising from the continuous logging of large numbers of temperatures by an operator, two special instrumentation and recording systems were employed. Approximately three-quarters (i.e., about 300) of the thermocouples were connected to a digital typewriter recording system which presented the temperatures in the form of a printed list, while the remainder were connected to six strip-chart recorders.

As readings of the temperatures were taken from the recorders, they were plotted in the form of a graph on a specially-constructed peg board in the control room. On this board temperature was plotted horizontally and the 100 thermocouples were plotted vertically. Thus by plotting the readings of these thermocouples during the stress-relieving operation an overall picture of the heating pattern was presented.

Adjacent to this board were two models, one of the pressure vessel and the other of the inner heat shield resting on the grid. Fixed to the models were small lamps in positions corresponding to those of the 100 thermocouples represented on the peg board. By placing a small plug in a thermocouple position on the board the appropriate lamp on the model lit up. The purpose of this arrangement was to enable the position of a thermocouple in the vessel to be located quickly if it showed that the temperature in that part was differing too widely from the mean temperature of the whole structure. Remedial action could then be taken by reference to electrical control information on the peg board.

Power and thermocouple cabling

Because of the high temperature involved, special arrangements were adopted to take the power supplies to the heating elements and from the thermocouple points inside the pressure vessel. Stainless-steel conductor rods were used for the power connection to the heaters, groups of these rods being taken in through the charge nozzles to supply the bottom crown and grid heaters, through cold gas ducts to supply the top-crown heaters. Welded connections were used between all the heater strips and the stainless-steel rods since it was imperative that no faults should arise at these points when the

stress-relieving operation was being carried out.

Mineral insulated stainless-steel-clad cables were used for all thermocouple leads. These cables were grouped together and brought out through nozzles in the pressure vessel. At suitable points outside the pressure vessel the m.i. cables were terminated in junction boxes from which normal multicore cables were run to eight further junction boxes in the control room. The leads from these boxes were then taken to the temperature-scanning equipment.

Although the South of Scotland Electricity Board made a 4.5-MW supply available for the stress-relieving, in fact the maximum demand never exceeded 3.6-MW, corresponding to 2 kW/ton of metal treated.

Power was taken from the main site substation through circuit-breakers to four 1,000 kVA 11/0.415 kV three-phase transformers, hired by the South of Scotland Electricity Board for stress-relieving purposes. Each of these transformers supplied six 150 kVA single-phase auto-transformers, two per phase in parallel, having voltage ratios of 10 equal steps. The auto-transformers were also individually switched to provide cycling control should the minimum voltage-tapping obtainable prove too high.

Thermal insulation

All external surfaces of the pressure vessel, ducts, and nozzles were insulated to reduce heat losses. In most cases this insulation consisted of two 3-in. thick (76.2 mm.) layers of Rocksil but in some instances, namely, round the duct stubs and skirt, the thickness was increased to 12 in. (30.4 cm.). Aluminium foil was widely used to reduce radiation and so protect the concrete surfaces. The inner layer of Rocksil had a density of 9 lb./cu. ft. and was backed on each side with a layer of 1-in.-mesh galvanised wire netting. The other layer was of similar construction but its density was 6-7 lb./cu. ft. and a 0.001 in. layer of aluminium foil was interposed between the insulation and the wire mesh on the outer face.

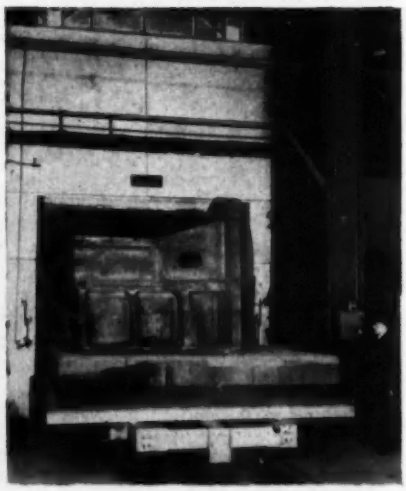
Stress-relieving operation

As there was no previous experience to draw on for controlling the heating rate of vessels of this size and complexity it was not possible to lay down a set of rules governing the operation. Initially the bottom crown heaters were switched on at their lowest setting, i.e., half load, and held at this level until the heating pattern emerged. The switching instructions were then based on this pattern. It was agreed to limit the rate of temperature rise to less than 9 deg. F./hr. and on this basis it took approximately seven days for the pressure vessel to reach the stress-relieving temperature of 1,022 deg. F. at which it was soaked for 12 hours. Throughout the whole operation there was not a single heater failure. As would be expected the overall rate of heating was controlled by that of the bottom crown, because natural convection tended to take the heat away from this part of the sphere. After the soaking period the vessel was left to cool for nine days before removing the thermal insulation. Entry to the vessel was delayed a further two days.

Over the past few weeks a considerable number of tests have been carried out on the fabricated structure to check the success of the stress-relieving These tests were laid down by Lloyds Register of Shipping (Land Division), with the approval of the U.K.A.E.A., the South of Scotland Electricity Board, and the consultants to the Board, Messrs. Kennedy & Donkin. They included crack-detection tests on 10 per cent. of all nozzle welds on the inner heat shield and on the grid, and 100 per cent. crack-detection tests of the nozzle welds in the shell and on the gussets. Untrasonic examination of selected areas on the top and bottom crowns was also carried out.

A STRESS-RELIEVING FURNACE

A furnace for stress-relieving large fabrications and castings weighing up to 40 tons has been supplied by the General Electric Co. Ltd. to Dorman Long (Steel) Limited. It is installed in the company's Redcar Iron and Steel Works and is capable of operating at a maximum temperature of 1,000 deg. C. The furnace is of the bogie-hearth or car-bottom type and has a door opening 10 ft. wide × 7 ft. high, and a heated length of 20 ft. The nickel-chrome strip heating elements are arranged on the side walls, roof and door. With all elements in circuit, the total rating is 600-kW, comprising 60-kW on the door and 540-kW arranged in four zones of equal length and power input. When the temperature reaches 10 deg. C. below the required value the input to the elements is automatically reduced to one-third of the maximum rating by star/delta contactors housed in the main switchgear cubicle. Four large-diameter centrifugal fans are provided in the roof of the furnace to increase the rate of heating and to ensure an even temperature distribution throughout the charge. Each fan unit is water-cooled. Eccentrically-mounted cams fitted to the door-lifting gear ensure that, when the door is closed, there is intimate contact between machined faces on the inside of the door and on the furnace front plate to prevent heat losses. Interlocks prevent the furnace from being switched on until the door is fully closed. The furnace bogie is carried on 12 single-flanged wheels, and is moved into and out of the furnace by a motorised wire-rope winch. The winch is fitted with an electromagnetic brake and a geared limit switch which automatically interrupts the supply to the driving motor at both ends of the bogie travel. Four indicating control pyrometers, one for each heating zone, are mounted in the control cubicle. The pyrometers are of the millivoltmeter type, complete with a broken-thermocouple protective device. Each instrument is fitted with two mercury switches which are used for controlling the supply to the heating elements.



A charge just entering the G.E.C. 600-kW bogie-hearth type furnace installed at the Redcar Iron & Steel Works of Dorman Long (Steel) Ltd.

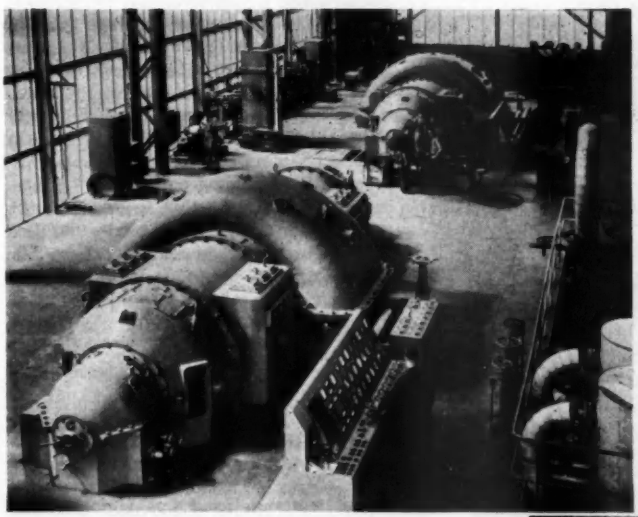
Annual Report of the Eire Electricity Supply Board

THE generation of electricity by the Electricity Supply Board, Ireland, for the year ended March 31st, 1961, increased by 166 million units or 7·9 per cent. over the previous year to a total of 2,262 million units, states the annual report, recently published. Due to favourable operating conditions, the output of the Board's hydro-electric stations exceeded 900 million units for the first time. Generation from peat rose to 755 million units, compared with 692 million units previously. The electricity supplied to the system was provided as follows:—hydro, 42·8 per cent.; peat (sod), 19·7 per cent.; peat (milled), 12·8 per cent.; coal (native), 4·4 per cent.; and oil/coal, 20·3 per cent. Generation from native sources amounted to 79·7 per cent. of the total output. The installed generating plant was adequate for all requirements and provided sufficient reserves to meet contingencies.

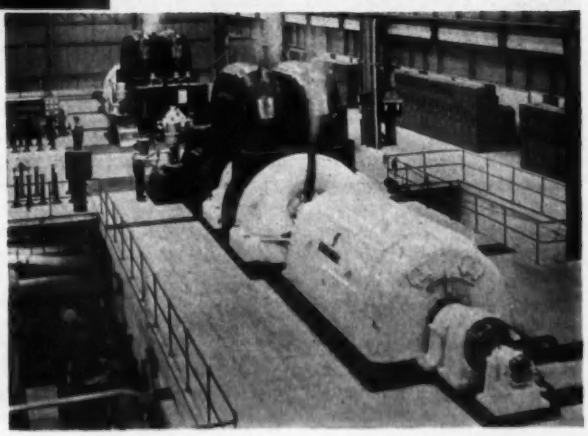
The demand for electricity has been growing steadily and sales realised £16,263,000, an increase of £1,539,000 over the preceding year, giving an increase in revenue of 10·4 per cent. The principal increases were in motive power and in domestic supplies. As foreshadowed in the Board's previous annual report, it was found necessary to introduce increased rates of charge during the year under review by an average of approximately 5 per cent. The result for the year, as shown in the net revenue account is a surplus of £577,828, which, together with £50,413 carried forward from the previous year, permitted the replacement of £400,000 withdrawn last year from the contingencies reserve.

It was decided, in view of the large financial commitments in plant and the increases in sizes of individual units, that a separate fund should be established to provide cover for special operational risks which are not covered by the general insurance arrangements. The fund, which is entitled "Plant Self Insurance —Special Risks," has been established by an allocation of £200,000 from earned surplus. Although this amount is relatively substantial, the character of the risks is such that it would not be sufficient to meet the losses likely to arise should a major plant failure occur. In the circumstances, the Board has also decided that the fund should be augmented in future years as the revenue position permits.

A balance of £28,241 remains to be carried forward to next year; this satisfactory revenue position, however, could not have been achieved despite the introduction of higher charges,



(Above). Turbine house interior at Rhode power station, showing the two 20-MW generating sets. A further set of 40-MW capacity is to be added shortly.



(Right). Marina power station (Cork City) generating capacity comprises two 30-MW sets, but is to be increased by the installation of a 60-MW set by 1963/64.

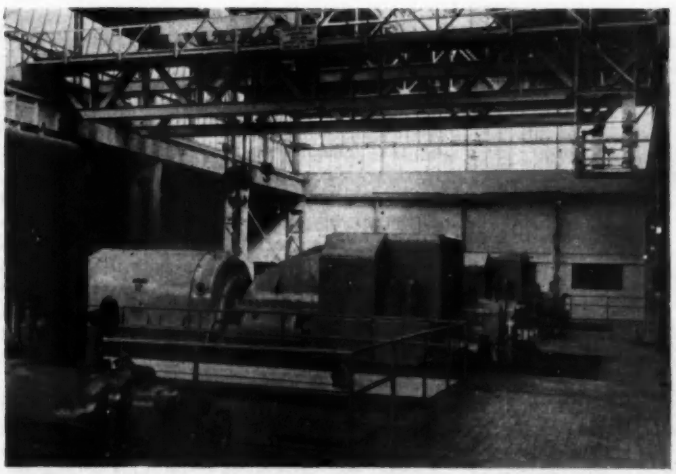
had operating conditions not been so favourable. Because of the very wet year, production from water power reached a record high figure, exceeding the average by about 200 million units, resulting in an estimated saving in fuel costs of some £500,000.

Generating plant extensions

The increase in recent years in the rate of growth of demand for electricity necessitated a review of future plant requirements and a revised programme of extensions of generating plant up to 1966/67 was prepared by the Board and approved by the Minister for Transport and Power. This programme includes peat-fired stations at Bellacorick (Co. Mayo) and Shannonbridge (Co. Offaly) as well as extensions of the peat-fired stations at Ferbane, Rhode, Lanesborough and Portarlington, and of the coal/oil fired stations at Marina (Cork) and Ringsend (Dublin). Within the next few years, substantial capital expenditure will be required on the extension and strengthening of the transmission system. In addition, the Board has under consideration the erection of a new 220 kV transmission network to provide for development in the demand for electricity.

The installed generating capacity of the Board's stations at March 31st, 1961, amounted to 723·5-MW, which includes 90-MW of old plant in the Pigeon House Station, Dublin, which is available for stand-by purposes, and the four 5-MW stations fired by hand-cut peat. New plant placed in commission comprised two 20-MW units at Rhode Station, Co. Offaly. The first unit went into operation on May 16th, and the second on July 16th, 1960. Additional generating plant, amounting to 386-MW, is under construction or in the course of being planned. During the period under review, 50 miles of 110 kV lines, 33 miles of 38 kV lines, 52 miles of 10 kV lines and 2,322 miles of rural lines were erected.

The value of plant brought into commission during the year was £4,469,174, of which £2,094,340 related to rural electrification. The total investment in assets in productive use at the end of the year was £109,079,164. In addition, expenditure of £3,436,557 was incurred on new capital works still under construction at the end of the year. The capital investment was over £112,500,000.



Ferbane Station (Co. Offaly) includes three 20-MW sets, and is to have a 30-MW to be ready for service early in 1964.

The capital requirements for the year were provided mainly from internal resources such as depreciation funds, and no new external borrowing was required. Part of the proceeds of the Electricity Supply Board 6 per cent. stock issue of March, 1958, is still available. The Electricity (Supply) Acts authorise the Board to incur capital expenditure not exceeding £120,000,000 for its general purposes. At March 31st, 1961, the Board had approved expenditure totalling £111,188,329 of which £80,678,542 represented electricity assets actually in commission, the balance of £30,509,787 representing either work in progress or work approved. The amount similarly authorised for rural electrification is £32,000,000, inclusive of the subsidy for rural development provided by the State. At March 31st, 1961, the amount approved was £29,985,988 of which £28,400,662 represented assets in commission and £1,585,326 work in progress or approved.

Rural electrification

The rural electrification programme was continued and 40 areas were completed within the year. Of the total number of 791 rural areas in the country, 92 per cent. have now been completed. The rural electrification programme is expected to be virtually complete by the end of the year 1961/62. Due to the revenue potential of the areas developed in more recent years being so meagre, each new area completed throws a fresh and continuing burden on the Board's resources. The deficit on the rural account amounted to £736,166. The areas now completed cover 21,118 square miles, or an average of 29 square miles per area, and the report points out that the proportion of dwellings connected in the completed areas is approximately 75 per cent.

The total value of materials used was approximately £1,220,000, of which about 82 per cent., or £1,000,400, was obtained from home suppliers. Capital expenditure amounted to £1,921,990, while the total invested in the scheme at March 31st, 1961, amounted to £29,253,966, of which £5,150,826 was by way of State subsidy.

The consumption of electricity by the rural community amounted to 388 million units as against 337 million units for the previous year. The average consumption for all consumers supplied under the rural electrification scheme was 1,479 units as against 1,351 last year—an increase of 9·5 per cent. The average consumption per domestic consumer advanced from 910 to 943 units, an increase of 3·6 per cent., while revenue earned was £4,529,498, at an average price of 2·8d.

At March 31st, 1961, the numerical strength of the Board's regular staff was 5,681, and of the temporary staff 2,204.

Research Laboratory for the Power Industry

A NEW mechanical engineering research laboratory was recently commissioned by C. A. Parsons & Co. Ltd. at their Heaton Works, Newcastle upon Tyne. It is equipped to provide research and experimental facilities suited to the rapidly changing requirements of the "power" generating industry and is additional to the extensive services already existing and the Parsons Nuclear Research Centre, which was established just over two years ago. In recent years, two important factors made it necessary to reconsider the research facilities available to cover the company's interests in turbines and axial and centrifugal compressors. The first was the immediate impact of nuclear energy and its expected growth; the second was the extraordinarily rapid increase in the size of individual machines combined with higher steam pressures and temperatures.

As far back as 1949, the company took steps to provide testing facilities which would permit of exploring the behaviour of axial and centrifugal compressors specifically designed for nuclear work, and operating as far as possible under working conditions. Plant for this purpose is large, costly and space consuming but in 1952 a closed-circuit compressor test rig was completed, the machines under test being driven by a 3,000 h.p. steam turbine. In a relatively short time, however, circulators grew in size and duty, and it became clear that a much larger test facility was necessary. At the same time, additional experimental equipment was needed to test and develop turbine blading for large steam turbines which, in the course of a few years, had developed from units of 60-MW to machines of over 500-MW. It was against this background that the new mechanical research laboratory was conceived. Some of the plant installed will fulfil not only the company's requirements but will also meet a national need. The compressor test rig, for example, is uniquely suited to full-scale testing of large circulators, and has therefore been made available to other manufacturers of large compressors for testing under industrial conditions.

A large modern building 250 ft. long × 65 ft. wide, was modified to suit the requirements of the laboratory. It houses two turbo-generator units which give a variable frequency supply to the experimental equipment. The building is well-suited for test purposes since it is close to both the boiler house and the cooling towers, has ample head-room for the work involved, and is serviced by a 40-ton crane. It has, too, an excellent approach both by rail and road. It was necessary to build a fairly large low-height annexe to house the ducting, coolers and measuring equipment associated with the closed circuit for the large scale compressor test rig.

This test rig is of the closed-circuit type employing 6 ft. 6 in. dia. ductwork 1¼ in. thick with a maximum working pressure and temperature of 300 lb./sq. in. and 300 deg. C. respectively. Circulators of up to 2,000 cu. ft./sec. capacity can be tested at these gas condtiions, and provision has also been made for testing conventional compressors with a maximum temperature rise of 230 deg. C. Circulators up to approximately 2,500 cu. ft./sec. capacity can be tested at lower pressure levels so as to keep within the output of the driving motors. Great care has been taken in the design to ensure a low overall pressure drop, an essential requirement for testing gas circulators with their low-pressure rise. For this reason a conical venturi in a metering length of 157 ft. has been chosen for measuring the mass flow. (Provision has been made for two throat diameters so that smaller flow rates can be accommodated.) The flow rate is controlled by a faired butterfly valve situated upstream from a cooler in the other leg of the rig.

The cooler is of the cross-flow gilled-tube type, the gas flowing outside the tubes and water through the tubes. The 11 ft. 6 in. dia. cylindrical pressure-vessel is designed to withstand an internal pressure of 300 lb./sq. in. and is 14 ft. 3 in. long at the full diameter and has an overall length of 33 ft. 9 in. Existing cooling towers have been increased in capacity to accommodate the load of both the above cooler and the two 5-MW turbo-alternators. This, in turn, necessitated a new pump house capable of

General view of Parsons new mechanical engineering research laboratory, showing (in middle foreground) the motor drive for the circulator and compressor test rig. On the platform in the background are the two 5-MW turbo-generators which supply power of varying frequencies to the laboratory.

dealing with an additional 150,000 gal./hr. of water.

The compressors or circulators are electrically-driven by two 5-MW steam turbo-generators housed at the east end of the building.

The driving motors are of the two-pole squirrel-cage type with external bearings and cooling arrangements. Dual windings are provided with six ends brought out so that with the various series parallel, star delta arrangements, the machines can be run at full load if necessary on 11-kV, 5.5-kV or 3.3-kV (at a frequency of 50 c/s). A pony motor is solidly coupled to the line for mechanical run-up purposes. This is a 1,500-h.p. slipring induction motor and is sufficient to run up the line to speed with the circuit at atmospheric presure. The advantage of the slipring motor is that it can run stably at speeds below synchronous for long periods unlike the squirrel-cage machines, and therefore allow time for mechanical inspection of the plant at low speeds. The machine is equipped with a continuously-rated liquid starter.

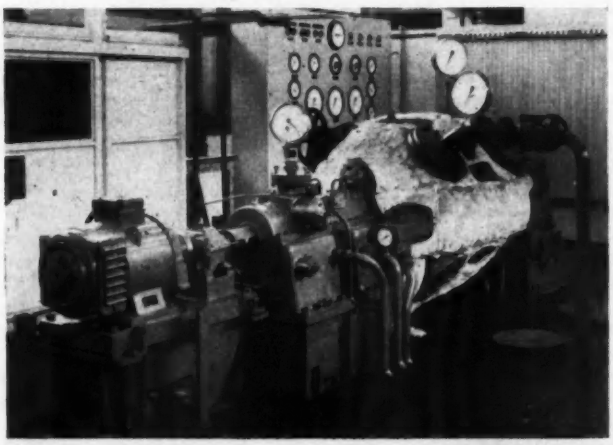
Instrumentation

A conical venturi meter measures the mass flow. This was chosen because of its well-proven characteristics and reliability. The pressures are measured in a control room close to the rig on normal water or mercury manometers; Betz micromanometers are available for smaller differential pressures. The speed is measured by a digital counter with a quartz crystal time element. Additional tachometers are available in both the control room and on the test floor.

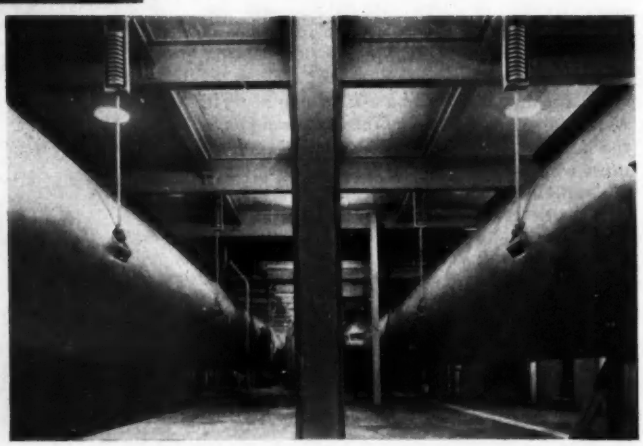
During aerodynamic tests at pressure up to 100 lb./sq. in. g. water or mercury manometers are used; at higher pressures Budenberg 10 in. standard test-gauges are used. The stagnation temperatures are measured by shielded couples and the rise over the circulator or blower by a system of iron/constantan thermocouples in series. During the high-temperature proving tests, the casing temperatures of the circulator are measured by copper/constantan thermocouples connected to an electronic potentiometric recorder.

180 h.p. model circulator test rig

This rig tests blading for gas-circulators and alternator fans. A venturi in the inlet duct is used for mass flow measurement, and the blower discharges through a butterfly-type valve. Generally, the rig will only be used on open-circuit although the casing can withstand two atmospheres, if necessary, for closed-circuit work. The fabricated outer casing is in three main parts. The middle portion, which is in one piece, carries an internal tubular member supported on eight radial ribs. This is bored out to form a tunnel into which are inserted the blade rings and distance pieces comprising the stator. The stator blades are set to the desired angle in the blade rings before being slid into the tunnel. The rotor, which also has adjustable blades, is split to take the blade roots, each blade being held in its desired setting by a set-screw. The rotor is mounted on a shaft carried in plain bearings, the bearing housing being welded to the ends of a tube which extends to connect up with the thrust block. This bearing-housing and thrust block assembly is mounted on three ball races, two of which are of the combined journal and thrust type for axial location against the thrust of the rotor. A single oil supply provides lubricant for the shaft bearings and the thrust. Both the front and rear portions of the circulator casing are split along the horizontal centre line so that the top halves can be removed for access to the



(Above). Variable density air turbine for more detailed research on turbine blading than is possible when using steam.



(Right). General view of compressor rig ducting in the annex to the laboratory.

blading and for alterations both to the internal ducts and to the fairings.

Variable density air turbine

To explore blading phenomena in more detail than is possible when using steam, a variable density air turbine is operating in the new laboratory. The air for this turbine is supplied from a motor-driven axial-flow compressor working in a closed-circuit with the turbine and a cooler to preserve the required temperature at the inlet of the turbine. By varying the density in the circuit, tests can be made over a range of Reynolds' numbers as well as over a range of velocity ratios. Great attention has been given to pressure and yaw measurement both " up-stream " and " down-stream " from the moving and stationary blading.

Experimental low-pressure steam turbine

The experimental steam turbine installed in the new laboratory, and briefly described below, has been primarily designed to investigate blading and other problems in low-pressure turbines. A great deal of thought was given to the type of rig suitable for these tests. Initially a full-scale turbine exhaust, using a very high vacuum to keep the power and steam demand within reason, was considered, but apart from the cost of such a project, its flexibility is limited. The plant installed is a scale model l.p. steam turbine which operates at normal vacua and well within the capacity of the present boiler plant. The inlet is modelled to provide uniform flow conditions and the exhaust casing is larger than scale size in order to provide room for alternative shapes of exhaust which can be of lighter scantling than the outer exhaust casing. The turbine exhausts into a condenser fitted with a condensate extraction pump and air-ejector, and volumetric tanks for the measurement of the water condensed. Cooling water is taken from the work's enlarged cooling-towers. An auxiliary condenser handles the steam passing the dummy contacts and the inlet end gland, and so prevents the augmentation of the flow through the blading. A separate extraction pump and air-ejector are supplied for the auxiliary condenser so that the vacuum in the two condensers can be kept the same.

The axial-flow compressor provides a high-pressure air supply which may be used in the air turbine, nozzle tester, wind tunnel and model test rigs and replaces less effective facilities in the old laboratory. Large CO_2 demands are made by the 10,000 h.p. circulator test rig and viscosity plate gas seal rigs. Bulk storage liquid CO_2 plant has, therefore, been installed in the laboratory.

Aerodynamic tests on model exhaust ends

It is desirable to keep the pressure-drop between the last blade row and the exhaust flange to a minimum in order to reduce the loss of available energy. This is of particular importance in machines of large output and so it is usual to prepare a scale model of the proposed exhaust end suitable for air or steam testing. The high speed air tests are now carried out on improved aerodynamic rigs in the new laboratory. The equipment includes two blowers connected in series each driven by a slip-ring motor. Each blower provides air at 68 in. total water gauge when running at 2,900 r.p.m. The air is fed into an 18 in. dia. duct which in turn can supply any one of four metering lengths, and the mass flow is controlled by a butterfly valve situated within the inlet ducting.

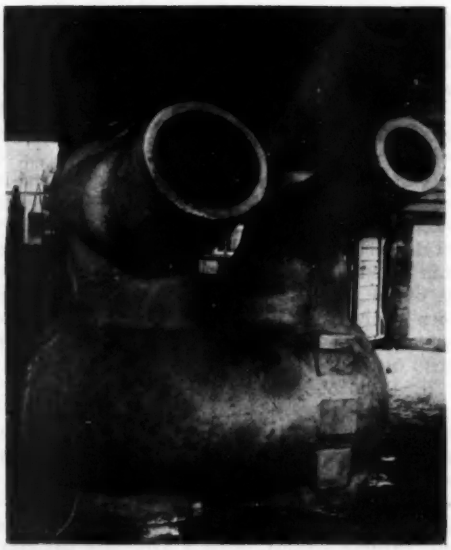
A low-speed wind tunnel for exploration of losses and pressure distribution is also provided, as a knowledge of the aerodynamic properties of a turbine nozzle or blade cascade is of importance to the turbine designer. In particular, the measured distribution of pressure around the blade profile provides an indication of both blade loading and boundary layer behaviour. Tests on suitable cascades of blades are now carried out on the above improved test facilities.

The laboratory was officially opened on Wednesday, June, 14th, 1961, by Mr. J. L. Gray, B.Sc., M.I.Mech.E., Turbine Plant Design Engineer of the Central Electricity Generating Board, in the presence of Mr. Gordon Baker, the managing director, as well as members of the board, senior officials, and the mechanical research and design staffs.

Co-operation in Casting Design

Two sets of intercept steam-chests for the C.E.G.B. West Thurrock 300-MW turbine generator installation provide an interesting example of the interchange of ideas between designers and foundry of the A.E.I. Group resulting in a better quality casting. The steam-chests were ordered from Armstrong Whitworth (Metal Industries) Ltd., Jarrow, by the Turbine Generator Division of Associated Electrical Industries Ltd. They are chrome-molybdenum-vanadium steel castings, for operating at a pressure of 700 lb./sq. in. and a temperature of 1,050 deg. F. In the preliminary stages the foundry made three proposals for modifying the design with the object of ensuring a perfectly sound casting. These proposals were accepted by the machine designers. First, the ends of the branches were modified. As originally designed these ends had thickened sections to be drilled and tapped so that studs could be inserted for fixing blanking plates for hydraulic test. These local thickenings raised the problem of possible casting flaws due to irregular metal distribution. There was also a possibility of leakage round the studs and the likelihood of problems in welding to the next section of the turbine. As modified, the thickened ends were eliminated, the branch walls were tapered from 2¼ in. thick to 1½ in. thick in an outwards direction to assist directional cooling, and an extra 3 in. was given to the branch ends. For pressure-testing, a groove was machined on the outside of the extension, and a split cover was clamped in position to seal off the end. After testing, the extra length of pipe end was machined off and the end machined to the required shape. Also, a modification was made to the main body of the chest to allow the branch cores to be supported by a tie-bar instead of by chaplets which, it was felt, might affect the flow of molten metal in the mould, and might not fuse completely. The accompanying illustration shows that the two branch ends (on the right) are at such an angle to each other and to the main body of the casting that a Y-shaped tie-bar could pass through both branches and through the main wall of the casting on the side opposite to the branch root, if a hole were provided in the main casting to accommodate the tie. For this purpose, a 6 in. dia. hole allowed the tail of the tie-bar to pass. After machining the hole will be sealed by a bolted-on cover plate.

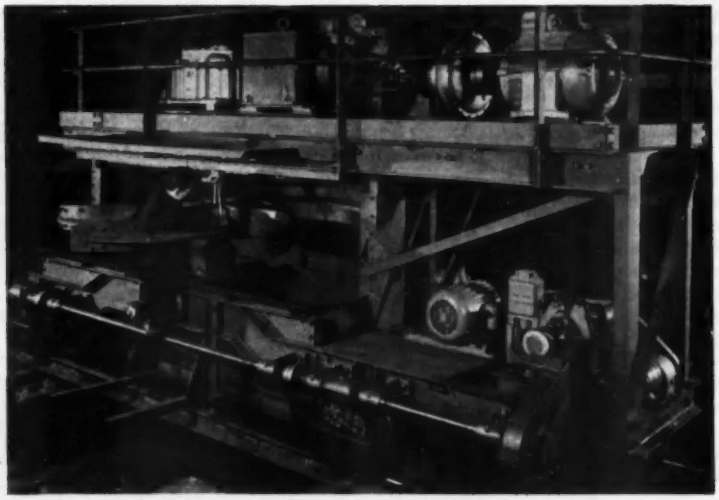
Thirdly, the original provisions for integral casting of the brackets used for handling and mounting the chest were discarded, again because of the possibility of unsoundness due to unequal brackets. Simple pads were cast on. These will be machined, and the brackets will be bolted into position. Three of the pads can be seen on the lower right-hand part of the casting illustrated. The finish-cast chests were subjected to gamma radiography and dye penetrant crack detection as well as hydraulic test.



(Above). One of the intercept steam chests cast for A.E.I. Ltd. by Armstrong Whitworth (Metal Industries) showing (on right) the branch ends which were tapered to assist directional solidification.

PADDLE FEEDERS FOR RICHBOROUGH POWER STATION

The General Electric Co. Ltd. has just despatched from its Erith Engineering Works, two identical 650-ton/hr. paddle feeders for installation in the new 360-MW power station at Richborough, Kent, now being built for the C.E.G.B. Main contractor for the coal-handling plant, of which these paddle feeders form a part, is the mechanical and electrical engineering division of George Wimpey & Co. Ltd., through whom the order was received. One of the paddle feeders will be installed beneath a 90-ft. long slot-discharge hopper located in the coal-storage area. The other paddle feeder will normally act as a standby unit, but there will be no provision for it to operate on the same set of rails as the first unit to assist in unloading the hopper. Coal is loaded into this hopper and is extracted from the shelf at the bottom by the paddle, which then discharges it onto the first of a series of conveyor belts which transport the coal to the boiler bunkers. The paddle is driven through gearing by a squirrel-cage induction motor, at speeds variable between approximately six and twenty-eight r.p.m. Overload protection of the paddle is provided by a fluid coupling interposed between the driving motor and the gear box.



(Left). One of the two 650 ton/hr. paddle feeders just before despatch from the G.E.C. Erith works to the C.E.G.B. power station at Richborough.

Motor-driven traversing facilities are fitted to the paddle feeders which will enable them to travel the length of the slot-discharge hopper. When the paddle feeders are to be used simultaneously for unloading the coal, limit switches will prevent over-travel of the two machines.

TWO NEW SCOTTISH THERMAL STATIONS

The South of Scotland Electricity Board has made an application to the Secretary of State for Scotland for consent to the construction of a 1,200-MW generating station at Cockenzie, East Lothian, and a 60-MW slurry-burning station at Methil Docks, Fife. The coal-fired Cockenzie station, which is estimated to cost £50 million, will contain four 300-MW turbo-alternators with steam pressure at the turbine stop valve of 2,350 lb./sq. in. and a temperature of 1,050 deg. F. There will be four 2,050,000 lb./hr. reheat boilers and circulating-water will be drawn from the Firth of Forth. Subject to consent, work is expected to begin on the station early next year and the programme provides for the commissioning of one 300-MW set each year from 1966. The installation at Methil Docks will consist of two 30-MW turbo-alternator sets with a steam pressure at the turbine stop valve of 900 lb./sq. in. and a temperature of 900 deg. F. The two boiler units will have a maximum continuous evaporative capacity of 275,000 lb./hr. The station will consume some 250,000 tons of slurry annually from existing deposits and current "make." The station is estimated to cost £5 million and is scheduled to be commissioned in 1965-66.

The 120-MW reheat boiler unit for the C.E.G.B. Padiham "B" Power Station is being supplied by **Simon-Carves Ltd.**, Cheadle Heath, Stockport, who estimate that the installation will be completed early in 1962. This boiler is designed for an evaporative capacity of 860,000 lb./hr. at 1,600 lb./sq. in. and 1,010 deg. F. with reheat to 1,005 deg. F. The boiler furnace will be of the continuous-slagging type which will allow for the ash and dust to be converted into a hard, granular substance that can be easily handled for disposal purposes.

RECENT *Equipment* AND *Accessories*

Froude D.A. 6590 hydraulic dynamometer

A Froude DA 6590 hydraulic dynamometer (Fig. 1), capable of absorbing and measuring up to 10,000 b.h.p. at speeds ranging from 3,750 to 10,000 r.p.m., is to be shown by Heenan & Froude Limited on Stand No. 132 at the 1961 S.B.A.C. Show, Farnborough. Specially designed for the testing of gas turbines and other types of prime mover, developing both high powers and high speeds, the Froude DA dynamometer is available in a number of sizes, the range extending from a machine capable of measuring 350 b.h.p. at speeds between 17,500 and 45,000 r.p.m. to one rated for 25,000 b.h.p. at 2,400 to 6,500 r.p.m. Prior to the advent of the DA range of dynamometers, the effective testing of high-power/high-speed turbines presented considerable difficulty, as the absorption of very high powers involves the circulation through the dynamometer of correspondingly large quantities of water. The incorporation of a conventional Froude rotor of sufficient size to achieve this, meant one of such dimensions that either the required high speeds could not be attained, or that too much power was absorbed. In the DA dynamometer, this problem is claimed to have been successfully solved by the incorporation of a special rotor, the diameter of which is some 25 per cent. less than that employed for other models. This innovation permits considerably higher speeds of rotation for the same peripheral velocities and, at the same time, has the valuable effect of reducing (in much higher proportion than the reduction in rotor diameter) the velocity with which the water leaves the rotor at maximum duty. Water velocities thus become much more manageable. Another departure from previous Froude designs is the absence of the sluice-gate form of control for masking the power absorbing elements and thus, regulating the load. In the DA machines, the load is controlled by a development of the "back-pressure outlet valve" used with the larger Froude FA dynamometers. Adjustment for a particular load-setting is by manual operation of a small bleed-off valve which determines the back-pressure set up by the double-beat valve, thus regulating the water content, and consequently, the load imposed. A form of remote load control can be provided at additional cost. Torque measurement, to a particularly high standard of accuracy, is achieved by means of a torque arm attached to the dynamometer casing and which may be connected to a variety of devices, such as load cells, spring balances, pendulum weighers, etc., depending on the nature of particular applications. (*Heenan & Froude Limited, Shrub Hill, Worcester.*)

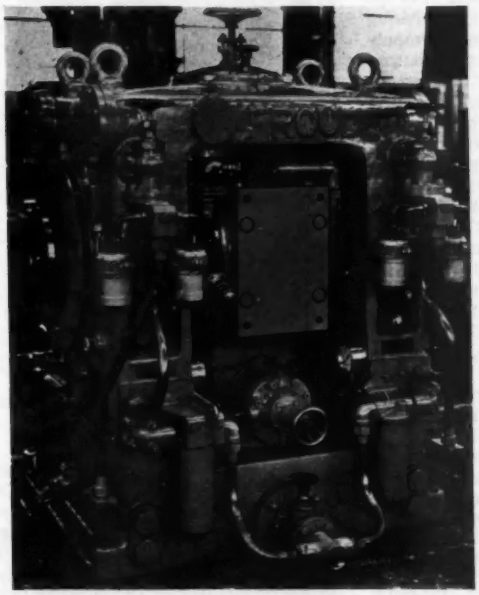


Fig. 1. Froude D.A. 6590 hydraulic dynamometer. (Heenan & Froude Ltd.)

Radiovisor smoke density equipment with "Everclean" window

Radiovisor Parent Limited have been granted a non-exclusive licence by the Central Electricity Generating Board to manufacture and sell the "Everclean" window which has been developed by the Central Electricity Research Laboratories and for which Patent Application No. 5654/59 has been lodged by the Board. The company claim to have designed the first industrial smoke density indicator more than 30 years ago and to have originated air-purging of the windows to keep them free from soot deposits. In many instances this is satisfactory but the "Everclean" window relies on the inability of dust and soot particles to travel along a bank of tubes or a honeycomb in which each tube or cell is long compared with its diameter. Tests carried out by the Board have shown that window cleaning can be reduced to once in 12/18 months. A design of "Everclean" window is also available for use where a positive flue-pressure exists. In the past it has been necessary, in these conditions, to employ compressed air for purging. The company are already supplying the "Everclean" window to some of the Board's generating stations for use with Radiovisor smoke-density indicators, 15 sets having been ordered for one station alone. Radiovisor smoke-density indicators and alarms are built to the relevant British Standards Specifications and carry the Kite mark. (*Radiovisor Parent Limited, Stanhope Works, High Path, S.W.9.*)

Linatex valves

The range of Linatex pinch-type valves has recently been expanded to embrace motorised and pneumatically-operated types. After considerable experience with the standard handwheel-operated valve in sizes from ½-8 in. bore, these have now also been extended to include 10, 12 and 14 in. bores. As is well known, the pinch-type valve has the merit of giving full-bore unrestricted flow when open. This makes it ideal for handling slurries and powders. The valve is glandless, and the basic design greatly facilitates maintenance, since it is necessary only to change the rubber sleeve to restore the condition of the valve. In most cases, especially when handling abrasive slurries or powders, the sleeve is made from Linatex rubber, as incorporated in Linatex pumps, pipe lines and other

material-handling equipment. For handling chemicals, the valve is fitted with sleeves made from an appropriate synthetic rubber material, and these include Butyl, Nitrile, Hypalon and Neoprene as dictated by the working conditions. To augment the range of valves referred to above, the company have also decided to market a range of non-return valves and safety/relief valves. A comprehensive technical booklet which gives details of the new range of Linatex valves and the various operating systems is available from the manufacturers. (*Wilkinson Rubber Linatex Limited, Camberley, Surrey.*)

New boiler feed pumps

Precision Electrical Products (Stockport) Limited have extended their range of electrically-driven pumps by the addition of the Type 14 boiler feed pump (Fig. 2). This new pump represents an advance in the conventional centrifugal pump design for boiler feed duties. It is of the regenerative turbine type, self-priming on the liquid ring principle. A particularly important effect obtained with this design which makes it eminently suitable for boiler feed work, is the fact that the regenerative turbine circulating effect in the pump casing develops about six times the head of a conventional centrifugal pump, having an impeller of equal peripheral velocity. Thus, the number of stages required to produce a given head are reduced, and high heads are possible at a motor speed of

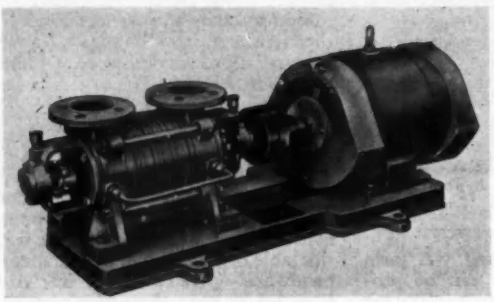


Fig. 2. Pep-Arco self-priming boiler feed pump. [Precision Electrical Poducts (Stockport) Ltd.)]

only 1,450 r.p.m. The self-priming characteristics enables the Type 14 impeller to handle vapour without losing prime. Even when pumping condensate at a temperature of 200 deg. F., the hot-well may be situated on the same level as the pump suction. This feature is particularly valuable for packaged steam-raising plant and installations in cramped boiler house conditions, where space limitations may present problems in the siting of the hot-well. The motor and pump of the Type 14 are completely separate units, and either may be removed from the bedplate without disturbing the other. This form of construction also enables clients to have any preferred make of British Standard drip-proof or totally-enclosed fan-cooled motor fitted, at little extra cost. The Type 15 pump is available in a number of different design variations depending on the capacity and head required. The standard range is suitable for handling condensate at up to 230 deg. F. with capacities of up to 120 gal./min. and heads up to 275 lb./sq. in. This pump is built to current insurance requirements for both land and marine installations and can be fitted with 50 or 60 cycles a.c., or d.c. motors. [*Precision Electrical Products (Stockport) Limited, Progress Works, Lytham Street, Cale Green, Stockport.*]

Mono Pumps Limited markets a gear pump

For many years, Mono Pumps Limited has marketed the Mono pump, which has proved an extremely versatile unit for solving many factory pumping duties. In developing its pumping service to industry, the company has been experimenting with various pumping principles for easy adaptation to integrated unit construction. An established gear-within-gear principle has been chosen for this purpose and the Menrow pump is now being manufactured and marketed. The pump is confined to the handling of non-abrasive fluids. The pumping mechanism can be contained within a small space and its capacity is high in relation to its size. A 100 gal./hr. pump can be made as small as 4 in. × 3 in. dia. It is a positive pump with a suction lift of 25 ft. The basic pumping unit can be arranged so that the flow can be in one direction with fixed rotation, in one direction irrespective of pump rotation, or as a reversible type with directional-flow towards either of the two ports. The suction and delivery can be arranged upright, horizontally opposed, or at right-angles. The manufacturers claim that it will operate efficiently at any angle of mounting. The pump can be foot-mounted, flange mounted, back mounted, gear or belt driven, or driven by a projecting tongue. The range extends from 35 gal./hr. to 4,800 gal./hr. capacities, with pressure up to 650 lb./sq. in. During the last five years the pump has been thoroughly field tested and is already in use on industrial oil-burning equipment and for oil-firing duties on packaged steam generators used for train heating. (*Mono Pumps Limited, Seckforde Street, Clerkenwell Green, London, E.C.1.*)

New powered bar-bender

A recently introduced semi-automatic machine, manufactured by Chamberlain Industries Limited, has been designed to bend black mild-steel bars up to 1¼ in. capacity and similar sections cold, while arrangements can be made for multiple bending of smaller sections. Of robust construction, the frame is constructed of steel, and all gearing, which is of adequate proportions, is machine cut. Ball races are used in all bearing houses with the exception of the main spindle, which has heavy bronze bushes more suited to deal with side thrust. The working surfaces are machined, and ample provision is made for lubrication. A three-way control handle is fitted for forward, neutral and reverse positions, and the rotating roller attached to the plate is controlled for angle of bend by means of a pin which can be placed in any of the holes provided. In order to obtain maximum bending speed, three pulleys are provided in an accessible guarded position. An adjustable plate is fitted to provide reaction close to the point of bend, thus ensuring a consistent radius throughout. The

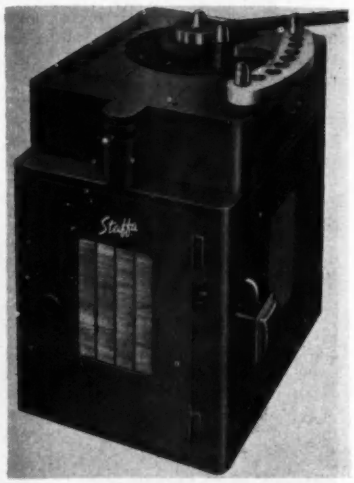


Fig. 3. Staffa bar-bending equipment. (Chamberlain Industries Ltd.)

power is provided by a 3 h.p. drip-proof motor on an adjustable tensioning table, provided with an isolator switch suitable for a 440/3/50 a.c. current supply and the gear-box is of proprietary manufacture. Interchangeable steel formers equal to 4 × D are provided to bend reinforced concrete bars from ⅜ in. to 1½ in. dia. to standard radii, and provision is made to conveniently house them in the locker incorporated in the pedestal. An adjustable reaction plate is fitted to support material close up to the centre former. (*Chamberlain Industries Limited, Staffa Works, Argall Avenue, London, E.10.*)

Edge-register control equipment

In many processes involving the handling of strip or web materials, it is necessary to reel the materials on to mandrels. As reeling speeds increase it becomes increasingly difficult to avoid "wandering" of the strip or web and, therefore, to maintain a "clean" edge of the complete reel. The edge-register control equipment (Series ERG1) is said to provide an economic means of controlling correction devices designed to position the edge of materials to within close limits. The equipment (Fig. 4) comprises a photoelectric viewing unit of "U" shaped construction through which the material passes,

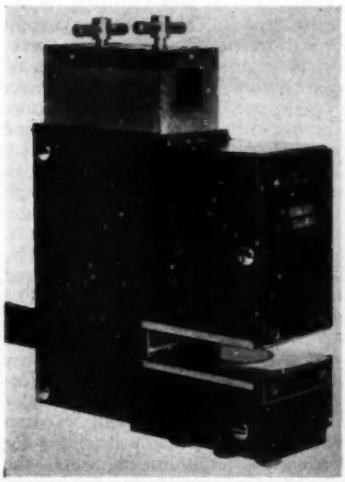


Fig. 4. Photoelectric viewing unit for edge register control equipment. (Lancashire Dynamo Electronic Products Ltd.)

together with a remote wall-mounted control unit. Twin photocells observe the edge of the strip or web, the system being arranged so that one cell is obscured and the other illuminated when the position is correct. If the edge of the material moves, the direction of the deviation is indicated by the photocell conditions and, after an adjustable delay period, the correction arrangements are initiated. After running for a predetermined time, the correction system is brought to rest and the equipment again checks the web position, repeating this operation until the edge of the material is restored to the correct location under the viewing head. The Series ERC1 equipment includes provision for the adjustment of "dead zone" over a 4 : 1 range, and is accurate to within ±1/32 in. when set up to the optimum sensitivity. "Correction" and "Observe" time delays are adjustable from 0.3 to 3 sec. and the two viewing heads are available, one having a "throat" depth of 3 in. and the alternative unit 6 in. The equipment is designed for 110/115 or 200/250 volts, 50/60 c/s single-phase supplies, and is fully described in publication E31013, available from the manufacturers. (*Lancashire Dynamo Electronic Products Limited, Rugeley, Staffs.*)

New cutting or welding blow pipe

An entirely new type of blow pipe, which is now available from Suffolk Iron Foundry, can, by a simple change of nozzle, be converted from a cutting torch into a welding torch. Claimed to be the only torch of its type available in this country, it does not require any conversion at the bottom of the shank. In addition, back-firing is claimed to have been eliminated. Called the "Double Duty Demon," it weighs only 1¼ lb., and is simple to manipulate. It will cut sheet metal and steel plate up to 2 in. thick, and can weld steel up to ¼ in. thickness. The handle of the torch has been specially designed and constructed, being of non-metallic composition with a non-slip fluted grip. The torch is supplied with three welding and two cutting nozzles which will handle most of the requirements of everyday welding and cutting. [*Suffolk Iron Foundry* (1920) *Limited, Sifbronze Works, Stowmarket, Suffolk.*]

Instrument warning device

The Stanley Sealey instrument warning device has been developed as an "add on" unit for use with standard instruments where it is required to initiate some action in the case of predetermined limits of operation being exceeded. The device consists of one or more photoelectric heads and a control unit, and in the event of one or more, or a certain combination, of several limits being exceeded, the device closes a pair of contacts in the control unit. The device is "fail safe" and the contacts may be used to initiate any action required.

The head is approximately ⅞ in. × ¼ in. × ⅜ in. and when used with a standard meter is merely applied to

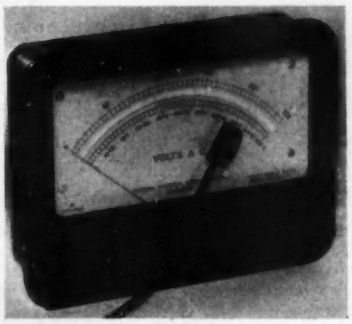


Fig. 5. Warning equipment for instruments. (Sealey Engineering Co. Ltd.)

the glass front of the meter at the predetermined level and below the meter scale. The head is small enough not to obscure the scale in the smallest meter and can be moved from meter to meter as the need arises. Although shown in the illustration (Fig. 5) affixed to a standard meter, the head may also be used with pen recorders, thermometers, etc. A recent application is the monitoring of a group of oil pump tubes to detect the passage of globules of oil, and to shut down the plant if the period between globules is excessive. Standard units are soon to be available and specials can be built to order to include complete control systems. (*Sealey Engineering Co. Ltd., Ruden Way, Reigate Road, Epsom, Surrey.*)

Aluminium air plug gauges

Teddington Industrial Equipment Limited have introduced a new, low-priced, type of air plug gauge known as "Hardcoat" plugs. These are made of aluminium specially processed to have a very hard surface. This, together with a large wear allowance, gives "Hardcoat" plugs a tough, thick wear surface, ensuring an exceptionally long life. Exhaustive laboratory tests, and field trials under very severe conditions, show, claim the manufacturers, that "Hardcoat" plugs will last approximately five times longer than chromium-plated gauges at a cost comparable to that of unplated steel air plugs. Being light in weight, "Hardcoat" plugs are easily handled, giving additional

advantages where large diameter holes are to be measured. Through and blind hole forms are available for all sizes larger than 0·400 in. and for holes of any depth. (*Teddington Industrial Equipment Limited, Sunbury-on-Thames, Middlesex.*)

New oil meter for very low flow rates

An oil meter, which can measure accurately the flow of fuel-oil at rates as low as 1½ gal./hr. under heads as low as 2 ft., is now available from Walker Crosweller & Co. Ltd. Previously it has not been possible to measure such low rates of flow with this standard type of instrument. Primarily intended for the measurement of the flow of fuel-oil to burners, the meter (Fig. 6) will provide an economic means of recording such information on many of the smaller industrial applications, such as oil-fired boilers, furnaces and ovens. The instrument, which is of the integrating type, is a specially calibrated version of the company's standard ½ in. Arkon oil meter, which is normally calibrated to read flows down to 4 gal./hr. An inherent feature of the design of this meter is its nutating piston principle—a flat disc oscillating on its periphery—which makes it extremely sensitive. This sensitivity, coupled with lengthy and precise calibration, has made the new version possible. It is said to be accurate to within ±1 per cent. (*Walker Crosweller & Co. Ltd., Cheltenham, Gloucester.*)

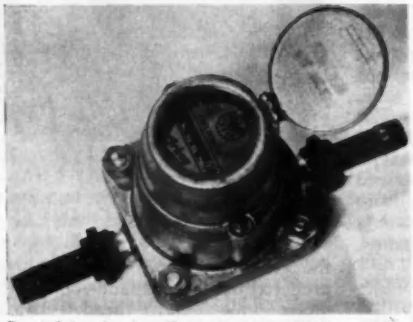


Fig. 6 (*above*). *Low-flow oil meter.* (*Walker Crosweller & Co. Ltd.*)

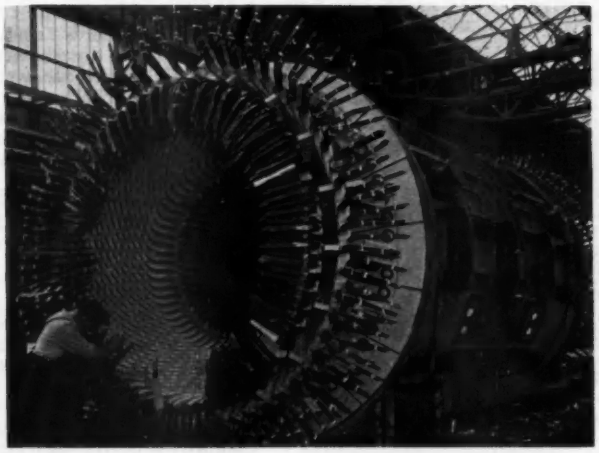


Fig. 7 (*right*). *Winding the water-cooled alternator stator of a 200-MW generator for Kincardine "B."* (*G.E.C. Engineering Group.*)

G.E.C. 200-MW generator under construction

Winding of the water-cooled stators of the two 200-MW generators which the General Electric Co. Ltd. is supplying to the South of Scotland Electricity Board for Kincardine "B" power station is proceeding at the Company's Witton Works. Each stator conductor comprises a number of thin-walled but robust rectangular copper tubes and solid copper strips. The design permits the best proportioning of the components to minimise loss and ensure hydraulic efficiency whilst enabling established winding techniques to be retained. In the simple coolant circuit, water enters the tubes through the main terminal bushings and leaves from only six points on the winding end turns. All pipework is metallic with brazed joints and there is no risk of water leakage within the machine. The stator core is spring-mounted in order to eliminate the transmission of vibration to the machine foundations. The core is held in the outer casing by means of four continuous longitudinal spring-systems placed on the vertical and horizontal centre lines of the stator. (*Engineering Group, General Electric Co. Ltd., Erith, Kent.*)

Cold cathode ionisation gauge

A new high-vacuum gauge, which can be in either portable or panel-mounted form and is for production work and general laboratory use, has been developed by Pulsometer Pumps Ltd. This is a Penning-type cold cathode ionisation gauge which has a range of from 10^{-3} to 10^{-6} Torr. The construction is in the form of a ring anode with two plate cathodes, one on either side, sealed in a glass bulb connected to the vacuum system. A permanent magnet produces a magnetic field directed along the axis of the electrodes. At the cathodes, field emission (that is to say liberation of electrons by high electric field) takes place, and the magnetic field causes these electrons to travel in helical paths. Thus, although the dimensions of the gauge may be much less than the mean free path of atoms at the pressure in the gauge, the actual distance travelled by electrons is greatly increased, together with their chance of ionising by collision. The final result is that electrons oscillate between the cathodes in helices and, since the anode has a small area, they can cause many ions to be formed before being lost to the anode. The ionisation current for a given electron current is, therefor, very large and so can be measured directly on a microammeter without any need for amplification. The gauge head is normally supplied enclosed in a metal case together with the magnet. Connection of the gauge head to the vacuum system is through a ½-in. Pulsometer vacuum union and to the control unit by a 4 ft. length of high-voltage cable. The gauge head can be supplied if required with a flanged adaptor piece. The Pulsometer high vacuum gauge can be used to detect small leaks in vacuum systems and is ideal for use in the manufacture of lamps, electronic valves and cathode ray tubes and for processes involving vacuum coating. It is specially intended for production requirements when the pressure is constantly fluctuating between atmospheric and high vacuum. (*Pulsometer High Vacuum Division, Nine Elms Iron Works, Reading, Berks.*)

Aid for metal spraying

The problems of using high-throughput metal spraying pistols have influenced Metallisation Ltd.

to produce an auxiliary spreader nozzle for attachment to their Mark 33 metal spraying pistol. This special attachment will spread the spray stream from a $\frac{3}{16}$ in. dia. wire to an effective width of 3 in. at normal spraying distance. In trials the nozzle has proved of considerable advantage when coating large surface areas. The use of high throughput pistols for the spraying of small or complicated shapes is not recommended since the most economical and effective metal spraying depends largely upon selection of the most suitable size of wire. Pistols such as the Mark 33 are capable of using wires varying in diameter from 1 mm. to $\frac{3}{16}$ in. so that the selection of wire demands only the change of a nozzle. The new spreader attachment has an additional feature in that it may be switched on and off independently of the pistol by means of a small tap situated at the base of the pistol. (*Metallisation Ltd., Pear Tree Lane, Dudley, Worcs.*)

Long-range photoelectric equipment

The use of photoelectric switching units using infra-red light beams for the protection of property against intrusion is now well known and accepted as normal. Large areas, however, are difficult to protect, particularly out-of-doors where equipment may be affected by vehicle headlights, and so on. The long-range photoelectric equipment, Series MPU.2 (Fig. 8) has been designed by Lancashire Dynamo Electronic Products Ltd., to be used in applications where the direct line of sight distance between the light project and receiver units may be as great as 1,500 yd. (1,370 m.). The problem of spurious operation due to extraneous light is overcome by the use of a "modulated" light beam so that the photoelectric receiver is sensitive only to this "modulation." Semiconductor techniques are used exclusively in the receiver unit and the system is arranged to "fail-to-safety" if tampered with. Suitable optical and mechanical arrangements are fitted on the standard equipment to enable initial alignment of the two units to be carried out readily. Apart from obvious applications as an intruder alarm the Series MPU.2 equipment may also be applied in industry where normal photoelectric units are in-operable due to brilliant ambient lighting, for example, near furnaces. (*Lancashire Dynamo Electronic Products Ltd., Rugeley, Staffs.*)

Fig. 8. Long-range photo-electric equipment. (Lancashire Dynamo Electronic Products Ltd.)

Floor heating by recovered condensate

Nearly two million B.Th.U./hr. of waste heat have been saved and further utilised at the Milk Marketing Board Creamery at Aberdeen by a system of flash-pots, calorifiers, and Girdlestone condensate recovery units manufactured and supplied by Girdlestone Pumps Ltd. of Woodbridge, Suffolk. At the creamery, skimmed milk is dried in five roller drier machines. Steam at approximately 80 lb./sq. in. is supplied from the boiler house to the machines. Each of the machines absorbs 2,000 lb./hr. of steam at full load, and the resulting condensate leaves the driers at a temperature of 320 deg. F., being received by a flash-pot where it is maintained at 5 lb./sq. in. pressure. The excess temperature is flashed off as steam at that pressure, and utilised in unit heaters in the works. The condensate from the heaters is brought to the discharge side of the flash-pot and the condensate then passed through a calorifier, which serves the underfloor heating for the canteen and other amenities. The amount of heat extracted from the calorifier reduces the temperature of the condensate from 227 deg. F. to 170 deg. F. and at that temperature the condensate enters a Girdlestone Condensate Recovery Unit before being pumped back into the boiler (Fig. 9). The recovery units run approximately 15 min. every hour, and are controlled by automatic switches. In winter, under optimum conditions, approximately 1,800,000 B.Th.U./hr. of waste heat are saved and further used for heating purposes, which represents a considerable economic saving. The recovery scheme was designed by Partridge, Earp & Partners, consultant engineers, of Edinburgh, and the installation was carried out by G. N. Haden & Sons Ltd., of Aberdeen. (*Girdlestone Pumps Ltd., Woodbridge, Suffolk.*)

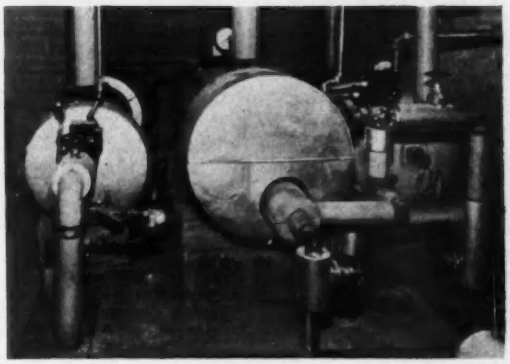


Fig. 9. O.P.S. calorifiers and one of the Girdlestone Recovery Units (next to right-hand wall) installed in an Aberdeen creamery. (Girdlestone Pumps Ltd.)

A new concept in welding

A new and remarkable piece of low cost welding equipment has been introduced into Britain. It is anticipated to have far-reaching effects in industry, particularly—though not solely—in sheet-metal construction work. Known as the Bren Weld (Fig. 10), it is built in the U.S.A. and marketed in the United Kingdom by E. P. Barrus (Concessionaires) Ltd. Essentially, the Bren Weld is a spot welder, but it works on the arc weld principle; that is to say it uses a coated electrode which cuts a hole through the metals to be welded, and simultaneously fills it so that the finished weld resembles a rivet. The heat is concentrated in a very small area by means of a nose guide shield. Therefore, there is no danger of distortion resulting from heat buckling the metal. A major advantage over conventional spot-welding equipment is the geunine port-

Coal has a bearing on

PROGRESSIVE INDUSTRY IS GOING FORWARD

ISSUED BY THE NATIONAL COAL BOARD

Vandervell success

Our modern world would grind to a halt without the thin wall bearing, which tames the destructive powers of friction and allows metals to revolve at high speeds without burning out. So precise and demanding are its tasks that its manufacture is the highly specialised work of Vandervell Products Ltd., whose famous bearings—supplied as original equipment to manufacturers in 15 countries—are constantly on duty on the land, on the sea and in the air.

Obviously the shrewd men who control such a thriving concern have a flair for making long-term decisions that are both wise and profitable. Vandervell choose coal because all their experience has proved that *coal*, the home-produced fuel, gives them all the steam for power they need at the lowest possible cost. They know that coal—mechanically stoked—is smokeless; they know that our coalfields contain all the coal that industry can use for scores of years to come.

When it is your duty to make a decision about fuel, remember Vandervell. They choose coal. The same choice could well help your business to run more smoothly.

ON COAL

Coal begins the complex processes which give industry its vital bearings

The Engineering Manager comments

"Vandervell Products Limited of Acton, West London, make Thin Wall Bearings and Bushings for the majority of the motor industries of Europe and supply original equipment to fifteen nations. The new works at Maidenhead, which now constitute the most important productive unit, use coal for the boilers.

The modern boilerhouse contains 3 high velocity two pass Economic boilers. The first produces steam at 65 p.s.i. reducing to 45 p.s.i. for process work in the factory, supplying heating coils in plating vats and de-greasing tanks. Maximum capacity is 10,000 lbs. of steam per hour, with a weekly average consumption of a little over 24 tons of coal. Steam production is just under 500,000 lbs. with about 95 per cent condensate return at a temperature of 150°F.

The other two boilers supply the low pressure hot water heating system for the works and offices. Each boiler has a capacity of 10,000,000 B.T.U./Hr. and operates at 27/30 p.s.i. The circulating system is by pumps although there is also a static water head of 30 ft. should both pumps fail, and a 60 ft. expansion safety head. The circulation rate is 40,000 gallons/hr.

The average temperature aimed at in the works and offices is 62°F. with unit heaters and gilled tubing respectively comprising the heating source. A calorifier fed from the steam boiler supplies hot water for kitchen use and in the toilets.

Coupled with high thermal efficiency is the completely smoke-free operation of all the boilers, which are fired by chain grate stokers, burning Eastwood washed smalls. A smoke density indicating device automatically rings an alarm bell and flashes a red warning light when flue gases rise above Ringelmann 2. Coal is mechanically conveyed from the storage point below ground by an elevator which carries the fuel to a cross-conveyor which feeds the large hoppers down to the stokers. Fuel deliveries have always been 100 per cent reliable. Even during the worst and foggiest periods of winter, one hundred tons were brought in each week with unfailing regularity by road, direct from the colliery."

Here are some key facts and figures about the consumption of coal by Vandervell Products Ltd.

No. of boilers: ..... 3 high velocity economic
Method of firing: ..... chain grate stokers
Steam pressure: ..... 100 p.s.i.
Steam temperature: ..... 334°F.
Max. continuous rating (1 boiler): ..... 10,000 lbs./hr.
Annual fuel consumption: ..... 3,200 tons

SOLID FUEL—more heat at less cost—and it's British

ability of the Bren Weld. It consists of a gun which weighs 2½ lb., connected by a flexible lead to a transformer. The total weight of gun and

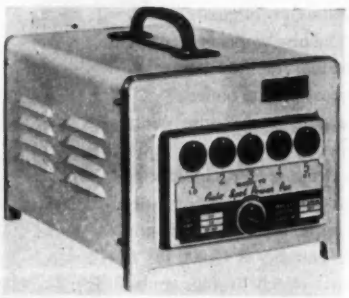


Fig. 10. Bren Weld Model 90 power pac. [*E. P. Barrus (Concessionaires) Ltd.*]

transformer combined is only 43½ lb. The "model 90" welding gun is fully-automatic in terms of feed, time control, and re-setting. A time control dial on the gun predetermines the forward travel of the electrode, and this in turn limits the time cycle of the welding current. No re-setting is necessary between welds, which is a point of special importance for production work. The versatility of the gun can be further extended by using alternative nose shields: concave, for external angles; convex, for internal angles; and lap. Each of these is available in three sizes. the "model 90" power pac, which measures only 8½ in. × 12 in. × 12½ in. overall. It incorporates the Transoidal transformer, the windings of which are double glass insulated, varnish impregnated and baked. The power pac has a range of five heat settings, adjustable in conjunction with the time control for varying gauges of metal. It can also be used for standard arc welding on a 20 per cent. cycle, and for this purpose is fitted with a thermal overload trip switch. [*E. P. Barrus (Concessionaires) Ltd., 12-16, Brunel Road, London W.3.*]

Gas-fired air-heater for Russia

Urquhart's (1926) Ltd., of Greenford, Middlesex had recently built a gas-fired air heater for the Engineering Division of Courtaulds Ltd., Coventry, who are building a fibre production plant in Russia. The air heater is direct-fired, burning natural gas methane for supplying hot air to a vacuum filter drying a salt. The air heater works against a back pressure of 6 in. w.g. It has automatic control of outlet temperature which operates by variation of the gas quantity burnt by adjusting the effective area of the final annulus of the gas burner, the gas pressure being maintained constant at all times. Air gas ration is controlled by "slaved" pulling motors and cams and a full range of safety interlock is incorporated, including u.v. flame-failure control, pressure switches and process interlock switches. The furnace used is an Urquhart High Intensity Combustion Chamber and can be offered for a very wide range of heat requirements and for burning most commercially available gases. [*Urquhart's (1926) Ltd., Wadsworth Road, Perivale, Middlesex.*]

Fuel oil pre-heat indicator

A robust and virtually fool-proof instrument enabling users to make rapid, on-the-spot tests of fuel oil to determine the exact pre-heat temperature required, has been developed by Shandon Scientific Co. Ltd. The Shandon Fuel Oil Pre-heat Indicator will cope with any variations in viscosity between one batch of fuel oil and another which, in the absence of individual viscosity tests, can result either in excessive and uneconomical pre-heating or in reduced burner efficiency through under-heating. Viscosity determinations, normally requiring laboratory facilities, it is claimed, can be made by the indicator in three minutes by unskilled personnel, the correct pre-heat temperature required being read directly from a clearly marked scale. The instrument consists, basically, of a steel cylinder, approximately 1½ in. dia. and 9 in. high, standing erect upon a special levelling base and fitted with a perforated plunger carrying the scale rod, which projects above the screw-top of the cylinder. The fall of the plunger in the cylinder is controlled by a cam, operated by an oil-filled "falling-ball" mechanism. The rod carries five separate scales, for atomising viscosities of 75, 110, 155, 200 and 400 sec. Redwood No. 1, these covering the requirements of most types of burner in normal use. Pre-heat temperatures for oils of a further seven atomising viscosities can be read from a simple chart supplied with the instrument. After the temperatures of the oil sample and instrument have been equilibrated by a simple process described in the instructions, the sample is introduced into the cylinder and the scale rod lifted to its fullest extent, where it remains locked by the cam. The timer is then turned through 180 deg. which releases the plunger and allows it to descend through the oil sample until the timer swings back to the locked position and prevents further descent. The correct pre-heat temperature required for that oil is then read off the scale rod at the point of emergence from the screw-top of the cylinder. The actual temperature at which the test is carried out is immaterial, since the viscosity index of the oil in the timer is approximately equal to that of all normal fuel oils, so that both timer and oil sample will be equally affected by ambient temperature. (*Shandon Scientific Co. Ltd., 6, Cromwell Place, London, S.W.7.*)

Rototherm surface-thermometer modification

A modification to their spring-fitting pipe-surface thermometer which makes one model adaptable for either horizontal or vertical pipes, is being marketed by the British Rototherm Co. Ltd. The thermometer (Fig. 11) now has four hooks—instead of two—at equidistant intervals at the rear of the dial. This

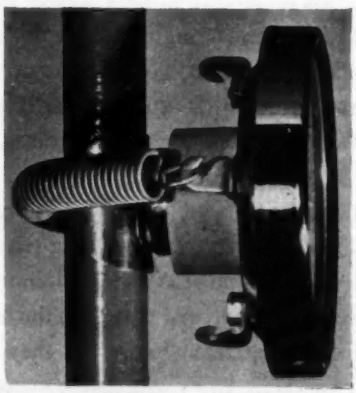


Fig. 11. Modified surface-thermometer. (*British Rototherm Co. Ltd.*)

allows the detachable spring, which clamps the thermometer to the pipe, to be fixed to the appropriate hooks, whatever the angle of the pipe. Previously, with the two-clip model, it was necessary to stipulate a horizontal or vertical model when ordering. The surface thermometers are designed for use where it is not convenient to insert the thermometer directly into the pipe and are particularly applicable for domestic heating apparatus. A soft, copper saddle, shaped to the contour of the pipe surface, ensures maximum thermal contact. The thermometer can be supplied with the spring suitable for pipes with a diameter of 1-1½ in., 1½-3 in., 2½-4 in., 3½-7 in. Standard ranges are 50 deg./250 deg. F., or

10 deg./120 deg. C. (*British Rototherm Co. Ltd., Merton Abbey, S.W.19.*)

Pneumatic control system components

New units with applications in pneumatic control systems are now available from Associated Electrical Industries Ltd., Instrumentation Division, Harlow, Essex. Two types of derivative unit are Type 59D, for direct, and Type 59R, for inverse derivative action. Simple assembly allows the units to be reassembled on site to give whichever action is needed. They can be added to a control circuit, positioned relative to the controller according to the application, when derivative action is required. With a clean supply air, Model 59 units are stated to be maintenance free having all the advantages of the A.E.I. force balance principle, that is deadspot, hysteresis and inaccuracies in the 1 : 1 ratio of transmission are virtually non-existent. Operating at a supply pressure of 25 lb./sq. in., the units have a derivative time adjustment from 0.2 to 20 min. Input and output pressure ranges are 3-15 lb./sq. in. Units may be operated at ambient temperatures between −60 deg. F. and +200 deg. F. The combined filter-regulator, Model 91F, removes oil fog and moisture from instrument supply air in pneumatic control systems as well as regulating it without flutter or oscillation. The continuous "blow-down" action, through a wool filtering material contained in a disposable cartridge, ensures reliable filtering, trapped oil and moisture being retained in the bottom chamber of the unit until the filter is blown off. Only one screw need be removed for inspection or cartridge replacement. The 91F regulator provides for right- or left-hand filling gauges; Model 91FG includes a 2 in. gauge. All connections are ¼ in. N.P.T. Range is 0-60 lb./sq. in. and capacity up to 12 s.c.f.m. (with a 100 lb./sq. in. supply and a setting of 20 lb./sq. in.). Maximum supply pressure is 250 lb./sq. in. (*A.E.I. Instrumentation Division, Harlow, Essex.*)

British Standard Methods of test for thermal insulating materials

This new British Standard (B.S. 2972 : 1961) differs from other British Standards dealing with thermal insulating materials in that it is concerned with the properties of the insulating materials themselves rather than with their performance after application. The other standards give minimum thickness figures for insulating materials to be used on domestic or industrial plant. These thicknesses are based on the thermal conductivity value of the insulating material and on the temperature and size of the hot surface to which the material is to be applied, but many users require more information about the physical and mechanical properties of the various commercial insulating materials, in order that those most suitable can be chosen for specific applications. It is very important that claims for technical quality of materials should be related to well-established tests based on sound principles, and the purpose of B.S. 2972 is to provide details of standard tests for the assessment of a range of properties which are likely to be of value to a potential user. Procedures are described for measuring dimensions and bulk density, assessing thermal properties, fire hazards, resistance to heat and compression, settlement and covering capacity. Also described are methods of determining the moisture content, moisture absorption, water vapour diffusance, odour, shot content and emissivity (for foil-faced insulation). It is not, of course, suggested that *all* these tests should be applied in every case. Copies of this Standard may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1, price 15s. each (postage will be charged extra to non-subscribers).

* * *

Associated Electrical Industries Ltd. has been awarded a £171,000 contract for the supply and installation of cables and accessories, including cable supporting steelwork, for two 200-MW generating sets at Kincardine "B" Power Station. The work will be carried out by A.E.I. Construction (Cables and Lines) Division for the South of Scotland Electricity Board, Consulting engineers are Messrs. Kennedy and Donkin.

Richardsons, Westgarth & Co. Ltd. announce that:—**Mr. J. D. Glanville,** at present with the United Kingdom Atomic Energy Authority at Risley, is appointed a director of the Company and will assume the responsibilities of group production director at the beginning of October, 1961. **Mr. W. R. Jones,** at present managing director of George Clark (Sunderland) Ltd., becomes group personnel director, and **Mr. H. Watson-Jones,** at present managing director of Richardsons, Westgarth (Hartlepool) Ltd., becomes group commerical director. Both remain directors of the parent Company. **Rear-Admiral J. G. C. Given** resigned from the Board on September 5th and will cease to be managing director of the Marine Division of the Group on September 30th when he leaves the service of the Company. From the same date the Subsidiary Companies (with the exception of Humber Graving Dock & Engineering Co. Ltd.) will become production units with centralisation of the main functions at Group Headquarters, Wallsend, and will no longer come under the direction of individual managing directors.

* * *

The largest generator transformers in the world will be manufactured by **Ferranti Ltd.,** as a result of an order received from the Central Electricity Generating Board. The order is for four 570 MVA, 3-phase, 22/430 kV delta-star-connected, 50 c/s, double-wound generator transformers, and the value exceeds £1 million. These units, which will be installed at the world's largest coal-fired power station at West Burton, Notts., will connect four 500-MW turbo-generators to the supergrid. Ferranti high-speed resistor transition on-load tap changing gear will be fitted to cater for voltage variations of ±10 per cent. in 18 steps. Cooling will be by means of forced-oil circulation through oil/water heat-exchangers. The weight of each complete transformer stripped for transport will be kept down to 215 tons, and dimensions will be 32 ft. 6 in. long by 13 ft. 6 in. wide and 16 ft. 2 in. high. This latest order follows those received from the C.E.G.B. for 310 MVA and 400 MVA generator transformers.

Recently, two more **Simon-Carves Ltd.** electro-precipitation plants for the Iron and Steel Industry have been ordered, at an approximate cost of £350,000. The first is for dealing with fume from two 360-ton open-hearth furnaces at the South Works of the South Durham Steel and Iron Co. Ltd., with a total gas volume of about 100,000 c.f.m. at 300 deg. C. The high-efficiency precipitators will clean the gases to 0.04 grain N.c.f. The second order is for five electro-precipitators to remove dust from the discharge end of a sinter strand being installed by Head Wrightson Iron and Steel Works Engineering Ltd., at Appleby Frodingham's Scunthorpe works. The guaranteed efficiency is 99.3 per cent., and the total gas volume will be about 335,000 c.f.m. at 212 deg. F. Simon-Carves' precipitator interests were merged with those of **Lodge-Cottrell Ltd.,** Birmingham, nearly a year ago.

* * *

George Kent Ltd. have opened a Sheffield District Office at Lloyds Bank Chambers, Earl Street, Sheffield, 1 (Telephone: Sheffield 77471/2). The Branch is under the supervision of **Mr. H. E. Farrar,** area manager, assisted by **Mr. G. H. Sharp,** senior sales engineer, and is able to provide technical and contracting facilities with the additional support of a district service engineer and team. Mr. Farrer is well known to clients in both the sales and service fields; Mr. Sharp was until recently concerned primarily with the metallurgical industry side of Head Office Sales Contracts Department.

* * *

To meet the increasing volume of orders and permit further expansion of their fractional horse power motor business, a new Division of **Evershed and Vignoles Ltd.** has been established at Devonshire Works, Dukes Avenue, Chiswick. Chief Applications Engineer, **Ernest H. Werninck,** who deals with home and export sales, has also moved to the new premises, and his telephone number is Chiswick 7801. It is anticipated that this move should shortly lead to quicker deliveries and will enable the already wide range of Evershed servo-motors, motor-generators and associated equipment to be even further enlarged.

in condensate systems

IN SPACE HEATERS, process heaters, evaporators and condensate lines Hagafilm forms a non-wettable film that protects vital surfaces from corrosion and improves heat transfer. Hagafilm has for long been used in America with striking results.

Now in the United Kingdom it is showing the same efficiency, and reducing maintenance and replacement costs considerably.

Albright & Wilson advice and technical service on the use of Hagafilm in the solving of water treatment problems is freely available.

**Registered Trade Marks of Albright & Wilson (Mfg) Ltd.*

For controlling corrosion and preventing hard water scale formation in water heating and cooling systems—**CALGON***

For small installations—**MICROMET***

THRESHOLD TREATMENT

with Albright & Wilson's Calgon (glassy sodium metaphosphate) has been firmly established as a reliable method of controlling corrosion and preventing hard water scale. Threshold Treatment is applied by adding a few parts per million of Calgon to the water used in heat exchangers, condensers and cooling systems.

For preventing scale deposits in high and low pressure boilers

PHOSPHATE CONDITIONING

Phosphate conditioning of boiler water is well established as the most satisfactory method of preventing scale deposits in all types of boilers. Scale cannot form when a reserve of phosphate is present in boiler water. Phosphate conditioning is indispensable at high pressures, and leads to such improvements at low pressures that it is generally preferred to other treatments.

Ask your supplier of boiler conditioning chemicals how little you would have to pay to be sure your boiler is scale-free all the time

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Look to **ALBRIGHT & WILSON** *chemicals for the answer to water treatment problems*

OVERSEAS Steam Engineering Practice

Abridgments of recent articles in the colonial and foreign technical press, concerning design and progress in the technique of steam generation and power plant equipment

New heat source in boosted burner

An American Gas Association group meeting at the A. D. Little Laboratories, Cambridge, Mass., recently received reports on their Association-sponsored basic investigation programme of the thermodynamic properties of a boosted burner, fuelled with natural gas. The programmed is part of the A.G.A. effort to explore new gas uses. One demonstration showed that boosting of the natural gas-air flame produces heat that melts a variety of metals from copper to tantalum (melting point, 5,400 deg. F.). Further, the addition of electric power, equal to one-half the chemical combustion power, at an optimum air-fuel ratio, boosted the specific enthalpy (heat content) of the gas from 1,100 to 1,600 B.Th.U./lb. Enthalpies of 9,000 B.Th.U./lb. were obtained with fuel-rich flames, and still higher figures are expected from increased electrical power. Tests indicate also that the heat flux to an external heat sink increases by a factor of three when the flame is boosted. The high-temperature, high specific enthalpy product of the electrically-boosted burner is held to be a potential heat source when either rapid, high-temperature heating, or an intense localised heat source above 3,000 deg. F. is desired. The demonstration showed the applicability of the burner to impingement heating, for such processes as cutting, welding, spalling, and drilling, because of the flame's high-temperature and high heat capacity. Heating of materials to a very high temperature, by feeding directly into the flame, is a logical use for the new device, especially when organic materials are used, since slower methods would destroy the molecules and form carbon and various oxides. Both radiant heating, as in open-hearth steel furnaces, and indirect heating could use the new boosted burner, the meeting was told, if refractory materials for suitably high temperatures can be economically used. Fluidised bed processes, for which a number of new uses are appearing, and submerged combustion techniques are two other applications the researchers found promising. The meeting learned that the use of cheap chemical energy, supplemented by relatively expensive electrical energy to obtain higher than normal temperatures, is the basis for the burner's operating economy. Operating costs were described as being dependent upon the fuels, oxidants, and electric power used and the temperatures required. The group was told that design flexibility makes possible utilisation of any commercially-available fuel—natural gas, fuel oil, powdered coal or hydrogen—with a range of oxidisers, from air or oxygen to florine or exotic mixtures. By varying the fuel-oxidiser feed rates, the burner is expected to provide a reducing, neutral, or oxidising atmosphere. (*Combustion*, Vol. 33, No. 1, July, 1961, p. 44.)

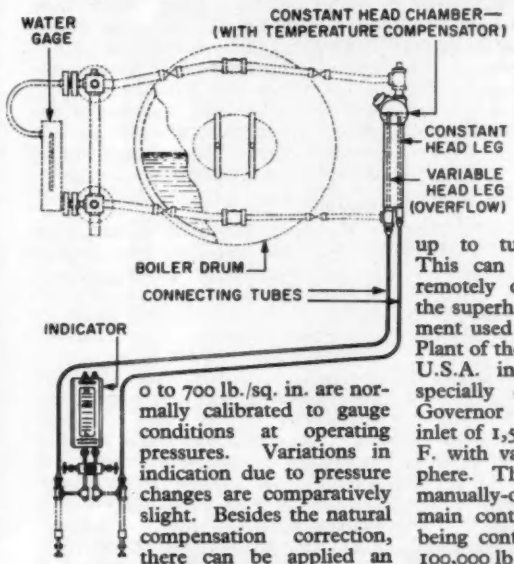
Power developments in Mauritius

Recent additions to the power resources of Mauritius include two new hydro-electric power stations, at Magenta and Eau Bleue, and the rebuilding of a hydro-electric station at Cascade Cécile, destroyed by a cyclone. It has also been decided to construct a new 42-MW thermal station, to be known as Fort George. Magenta station, which was opened by the Governor, Sir Colville Montgomery Deverell, on March 29th, is equipped with a 1,000-kW Gilkes Francis turbine, and a Bruce Peebles alternator, and will produce four million kWh per annum. It is remotely controlled from Tamarind Falls station further upstream, the discharge water from which is conveyed by pipe line through a head of 150 ft. to the new station. Eau Bleue hydro station comprises two 2,000-kW Gilkes Turgo turbines and English Electric alternators operating under a head of 600 ft. Drawing water from a newly constructed reservoir of 216 million cu. ft. capacity with a 2,500 ft. dam, the station is expected to give 18 million kWh annually. As mentioned above, the Central Electricity Board of Mauritius has decided to build a thermal station at Fort George, Port Louis. The first stage, comprising two 6-MW diesel sets, is under construction and should be commissioned early in 1963. Orders for the first two sets have been placed with Fiat of Turin. The project is being carried out by the Board's consultants, Messrs. Preece, Cardew & Rider, London. The small hydro-electric station at Cascade Cécile is to be replaced by a larger station further downstream. To be built with local resources, the station due for commissioning in 1963, will be of 1,000-kW capacity with an annual output of 4 million kWh. The board has also approved plans for the reconstruction of several urban distribution systems severely damaged by cyclones, together with the erection of new 66-kV and 22-kV transmission lines across the island.

Remote level indication for high-pressure boilers

As the distance between the water-gauge glass and the boiler house operating-floor increased, the water-level devices need one or more auxiliary aids to ensure accurate reading. A new remote liquid level indicator designed to supplement the gauge glass used the pressure differential between a constant head of water in the head chamber and the varying head of water in the boiler drum to actuate the pointer of a differential pressure indicator. The constant head chamber, or ambient temperature column, is located above the high-water level and connected to the upper portion (steam space) of the boiler drum. A connection is also made from the variable head leg to the lower portion (water space) of the drum. The level of the water in the constant head chamber is maintained by condensation in the steam space. Condensate formed in the chamber overflows into the variable head leg, and it is this overflow level which provides the constant static head. Pressure created by the static head of water in the chamber is transmitted through the right-hand tube to one side of the indicator. The left-hand tube is connected to the lower fitting of the boiler drum and produces a variable static head on the indicator as the water level in the drum changes. Variations in the differential pressures (difference between the constant and variable

pressures in the right- and left-hand tubes, respectively) cause a movement of the indicator pointer, which indicates the water level. Indicators may be mounted on the boiler control panel, or installed at any other location convenient to the operator. Remote indicators for pressures of



Arrangement of remote liquid level indicator system which uses the pressure differential between the head chamber and boiler drum.

0 to 700 lb./sq. in. are normally calibrated to gauge conditions at operating pressures. Variations in indication due to pressure changes are comparatively slight. Besides the natural compensation correction, there can be applied an additional correction by means of calibrating to the average density value. For steam pressures in excess of 700 lb./sq. in. where boiler water temperatures are relatively high, natural compensation is not sufficient for the necessary accuracy between the reading of the indicator and the water glass. Density changes due to increasing temperatures become sufficiently pronounced to require additional measures to maintain accuracy of indication. For these applications a constant head chamber is fitted with a temperature compensating unit, thereby producing accurate readings at normal (mid-scale) water levels at all pressures and full scale indicator accuracy at the specified operating pressure. This unit is a controlled temperature column which retains the stability characteristics of an ambient temperature column even under conditions of radically changing boiler pressures. (*Power Engineering*, Vol. 65, No. 8, August 1961, pp. 50-52.)

Matching steam and turbine temperatures

An inherent problem with starting and loading cycles—such as occur during the night or at weekends—is the transient thermal stresses in the turbine shell and valves. If these stresses are large enough to produce plastic strain, a sufficient number of cycles will cause metal cracking. And if steam and turbine-metal temperatures are not reasonably well matched, there is danger of rubbing between the spindle and stationary parts. One solution is to increase the steam-generator flow to bring steam up to turbine-metal temperature. This can be done by installing a remotely controlled drain valve on the superheater outlet. The arrangement used at the Arsenal Hill Power Plant of the Southwestern Power Co., U.S.A. incorporates a 3 in. valve, specially designed by the Fisher Governor Co. which handles the inlet of 1,550 lb./sq. in. at 1,005 deg. F. with valve discharging to atmosphere. The valve is positioned by a manually-operated panel loader in the main control room, the steam flow being controlled from zero to about 100,000 lb./hr., depending on boiler pressure. Wide control range also allows this valve to vent the superheater during startups. A pneumatic controller operates the valve automatically as a relief valve and prevents operation of the other steam safety valves on excess boiler pressure. The controller set-point is 1,600 lb./sq. in. (gauge); superheater safety valve relieves at 1,640 lb./sq. in. (gauge). In normal operation the control valve is closed and the top port of each switching valve is open. The panel loader is manually positioned to vent the superheater or increase superheater flow to match steam and metal temperature. The loader increases the air output to the control valve and also the switching valve. When pressure increases to 5 lb./sq. in., the upper port of the switching valve closes, opening the lower port and venting the top diaphragm chamber of the control valve. At 6 lb./sq. in. the positioner starts opening the control valve, venting steam to atmosphere. Steam flow can also be reduced by the panel loader. When the pressure drops below 5 lb./sq. in., air at 18 lb./sq. in. enters the top diaphragm chamber of the control valve through the switching valve. A seating force of 12,000 lb. from top diaphragm chamber produced by the spring and the 18 lb./sq. in. loading gives bubble-tight shut-off against extremely high unbalance. Automatic relief occurs when the superheater outlet pressure reaches 1,600 lb./sq. in. At this point the controller transmits 6 lb./sq. in loading to a second switching valve, closing the upper port and opening the lower one. This passes a 30 lb./sq. in. loading to the control valve positioner and to the first switching valve. The top diaphragm chamber of the control valve is vented and 30 lb./sq. in. is transmitted to the lower diaphragm chamber, rapidly opening the control valve. After an overnight shutdown, turbine-metal temperature in the nozzle bowls and steam chest falls to about 725 deg. F. With top burners in service and 30° up-burner tilt, a temperature of 800 deg. F. can be obtained before the turbine starts to turn. During 1960 the control valve was manually operated on 34 startups to drain the superheater or increase superheater flow to match steam and the turbine-metal temperature. (*Power*, Vol. 105, No. 9, September 1961, p. 79.)

Australia: rapid fuel and power development

During June, a 22-man exploratory mission from the Japanese steel industry studied the Australian bituminous-coal industry. The visitors paid particular attention to coal-loading facilities at the ports which, they pointed out, must be greatly improved before the projected large export tonnages for Japan can be shipped. However, there are signs that improvements are imminent. The Maritime Services Board has called tenders for the construction of a new shiploader at Balmain, Sydney; and both the State and Federal Governments have given assurances that finance will be made available for the rapid construction of major coal-loading facilities at Newcastle and Port Kembla. Furthermore, a major coking-coal producer has offered to construct at its own expense a 2,000-tons per hour offshore loader near Port Kembla, subject to the conclusion of satisfactory financial arrangements with overseas customers. The wharf at Balmain will have a coal-loading capacity of a million tons a year, and will be able to accommodate ships of 30,000 to 35,000 tons capacity. Two conveyor belts will load coal at the rate of 1,000 tons an hour, compared with the present figure of 200 tons an hour by crane. According to a recent statement by Mr P. N. Ryan, New South Wales Minister for Public Works, the Government is inviting tenders in Australia, London, and New York, for a project to deepen

the entrance to Newcastle Harbour in order to cater for vessels of 30,000 up to 35,000 tons. A 10-ft. depth of solid rock is to be removed over a wide area of the sea bed from 25 ft. 6 in. at low tide to 36 ft., and the work will probably take at least three years. New South Wales coal mines produced a record 18 million tons in the past financial year, being a 10 per cent. increase on the output for the previous financial year. Coal production in 1960-61 increased by 1,655,000 tons on 1959-60. Exports were almost doubled, increasing by 865,400 tons to 1,846,200 tons. The greatest increase in production took place in the Southern district, where production rose by 1,083,000 tons to 6,217,000 tons. Though the South Maitland field had been faced with problems of labour displacement resulting from the closure of six mines its total output rose by 304,000 tons 3,065,000 tons and there was a 5c per cent. rise in output per manshift. For the State as a whole the average output of all underground mines per manshift was up by 19 per cent.

New South Wales Electricity Commission

According to the last annual report of the Commission, sales of electricity increased during the year by 10.8 per cent. to 7,000 million kWh, while the average price per kWh sold, fell from 1.679d. to 1.620d. During 1959-60 the following generating plant was put into service: one 15-MW turbo-generator set with 170,000-lb./hr. boiler at Muswellbrook power staion; one 30-MW turbo-generator set with 300,000-lb./hr. boiler at Wallerang; and one 60-MW generator with 550,000 lb./hr. boiler at Wangi. In addition, a 50-MW hydro-power installation was brought into operation at the Warragamba dam, near Sydney. The Commission has achieved a remarkable reduction in the average direct cost of generation in the past 10 years, as shown by the following figures: 1951-52, 1.058 pence per kWh; 1952-53, 1.034; 1953-54, 0.913; 1954-55, 0.866; 1955-56, 0.840; 1956-57, 0.810; 1957-58, 0.722; 1958-59, 0.656; 1959-60, 0.579. The Commission met an all-time record peak demand for electricity of 1,866-MW on June 22nd —the shortest day in the Australian year. Last year's peak winter demand was 1,768-MW, compared with 1,058 MW in 1955. The Commission had 20 stations operating when the record demand was met this year. They were: Wangi, 349-MW; Bunnerong, 336; Tallawarra, 240; Pyrmont, 204; Wallerawang, 145; White Bay, 120; Balmain, 84; Warragamba Dam, 45; Zarra Street, 36; Muswellbrook and Ultimo, 33 each; Liverpool, 21; Maitland, Penrith, and Tamworth, 15 each; Burrinjuck, 13; Ulan, 7; and Wyangala, 5. The Commission also supplied 7-MW in its Broken Hill subsystem and one megawatt in its Bourke subsystem. To help meet the demand, the Commission used 116-MW from the Snowy Mountains generators at T1, and 12-MW from Guthega. The Commission has increased its installed capacity from 490-MW in 1950 to 2,142-MW this year.

Queensland

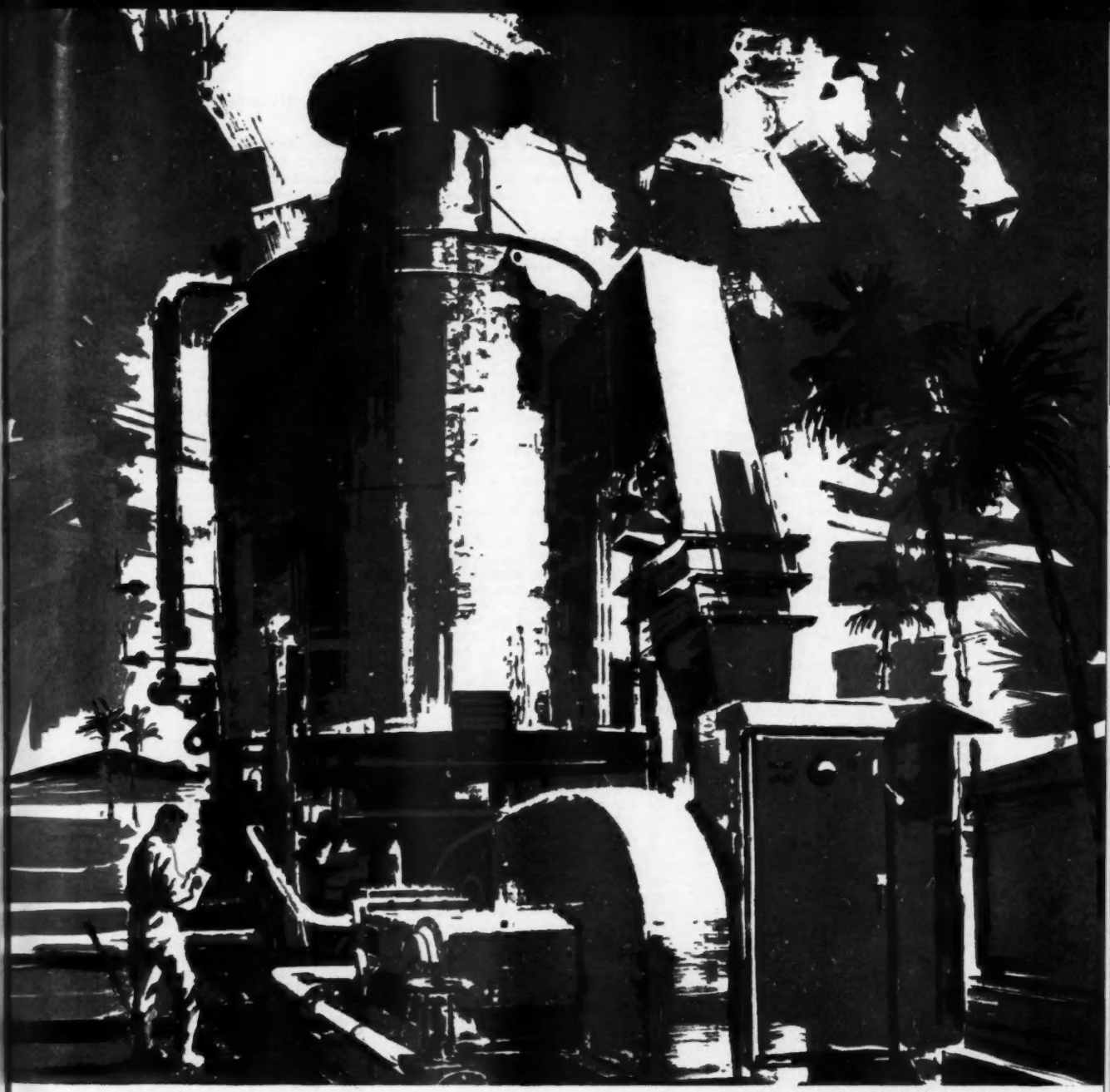
Speaking at Rockhampton recently, the Minister for Development, mines, main roads, and electricity, the Hon. E. Evans, M.L.A., dealt with the Government's plans to build a modern power station to meet Queensland's rapidly-growing electricity requirements. He said that there had been strong local pressure to have the station located on the West Moreton or Callide coalfields. It was probable that it would be of a conventional coal type with provision for future boosting of power from natural gas should present exploration work yield a commercial gas field in the State. The plant would cost about £A48 million and the British engineering consultants Merz and McLellan had been engaged to investigate the whole question of electricity supply in Queensland and to make recommendations. Following 12 months' investigational work, including seismic surveys, two large American oil companies—Phillips Petroleum Co. and Sunray Mid-Continent Oil Co., have let a contract to Delta Drilling Co. of Tyler, Texas, U.S.A., to drill a deep test-well to 10,000 ft. at a selected site about 20 miles north of Quilpie. Preparation of the site includes the laying down of an air-strip, construction of a drilling camp and water-well both for drinking and drilling purposes, and an air-conditioned township for the drilling and ancillary crews. Drilling will probably take 4-6 months and cost about £A420,000. The power station at Roma is shortly to be connected by pipeline with recently-discovered sources of natural gas at the A.A.O.4 (Hospital Hill) and Timbury Hill wells for trials to check their flow characteristics. If the experiment proves successful, full-scale production may be established, warranting a pipeline to Brisbane. The Queensland Government has entered into an agreement with Amoco Holdings Pty. Ltd., and Amoco Australia Pty. Ltd. for the construction of an £A11 million oil refinery on Bulwer Island, near the mouth of the Brisbane River. The agreement provides for the dredging of the north-west channel off Brabie Island, Moreton Bay Channels, and a swing basin near Mud Island by the Queensland Government at a cost of £A1½-2 million. Plans have been made by the Australian Ampol Petroleum Ltd. to build an £A18 million oil refinery on a 40-acre site at Port Alma, near Rockhampton. It will be about twice the size of the Amoco refinery, and will be big enough to meet the requirements of the whole of Queensland.

Victoria

The State Electricity Commission of Victoria has put into regular service the largest turbo-generator set installed in Australia. This is the first of the two 120-MW machines in the new Yallourn "E" extension. The second 120-MW generator is now being installed, and is due to start operating early next year. Commissioning of the first Yallourn "E" generator raises the installed generating capacity of the station to 500-MW—the largest in Australia. Generation is at 13,800 V, which is stepped up to 220,000 V for transmission to terminal stations in Melbourne, where Yallourn's output is fed into the S.E.C. supply network now covering most of the State. There is one boiler only for each generator at Yallourn "E." Fuel is raw brown coal which is pulverised, dried by flue gases, and blown into the combustion chambers, where it is burnt in suspension. Each boiler consumes 215 tons/hr. of brown coal; output is 1,000,000 lb. of steam per hour at 1,600 lb./sq. in. and 1,050 deg. F. The Hazelwood station, now under construction in the Latrobe Valley, will have 200-MW generators. The first of these is due to be commissioned early in 1964.

World Power Conference, 1962

Sir Edward Warren, vice-chairman of the Australian National Committee of the World Power Conference, attended a meeting in July, held in Moscow, of the International Executive Council of the Conference. Among other matters discussed was the Plenary Session to be held in Melbourne from October 20th to 26th, 1962. Other office bearers of the Australian Committee are: chairman, Mr. W. H. Connolly, who is chairman of the Electricity Supply Association of Australia and of the State Electricity Commission of Victoria; secretary, Mr. A. H. Cadd, secretary of the Electricity Supply Association of Australia; and execu-



Mitchells 'packaged' coil boiler under test

Power in a Package

Mitchell's new 'packaged' boiler supplies 10 tons of high-pressure steam an hour for Shell oil wells in Venezuela

The requirements of Compania Shell de Venezuela for high pressure steam at their Venezuelan oilfields dictated a boiler of a special type—a high pressure, forced circulation coil boiler with a capacity of 10 tons an hour. Mitchells designed and built a boiler to meet all these requirements and, in fact, it is now in full operation. Moreover, it is a true "packaged" boiler, i.e. one that can be shipped as a whole. Mitchells have thus paved the way for a whole new family of powerful, compact and transportable boilers.

Mitchells are also active in the fields of boiler design, cableways and ropeways, wagon handling, transporters and conveyors, cranes, mills, ship loading plant and nuclear power.

MITCHELL

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ONE BEDFORD SQUARE · LONDON

tive member, Mr. C. W. Goodman. The theme of the Melbourne Conference is "The changing pattern of power." It covers analyses of energy resources and the way they are being used. Studies will also be made of the competition between the various sources of power. Australian engineers see in the conference an excellent opportunity to compare their performance with the latest overseas practice, and to entertain men whose technical advice has helped Australia's power industry to attain its present high standards.

Combustion Engineering Conference

A one-day conference has been arranged by the **Combustion Engineering Association** to take place on Thursday, October 19th next, at the Northern Exhibition of Fuel and Power for Industry at the Queens Hall, Leeds, at 10.15 a.m. The opening address will be given by the chairman of the conference, **Mr. N. A. McNeill,** engineer-in-chief, Unilever Limited, president of the Association. The morning session will be devoted to grit and dust from small boiler plants. A paper on the measurement of air pollution and the equipment for prevention will be presented by Dr. R. Jackson (British Coal Utilisation Research Association) and another on the cost of installation and maintenance of equipment by Mr. H. Westwood (James Howden & Co. Ltd.). At the afternoon session a paper will be presented by Mr. G. Gill (National Industrial Fuel Efficiency Service) on the seventh N.I.F.E.S. progress survey.

* * *

Associated Electrical Industries Ltd. has received an order worth £231,000 from the State Electricity Commission, Victoria, Australia, for 6.6-kV auxiliary switchgear at the Commission's Hazelwood Power Station. The order is for 350-MVA vertical plug-in equipments, which will be manufactured mainly in the U.K. factories of A.E.I. Switchgear Division, though certain contactors and panels will be made in A.E.I. factories in Australia. Hazelwood, planned for an ultimate output capacity of 1,200-MW, will be the largest thermal station in Australia. A.E.I. is already supplying two 200-MW turbo-generator sets, main transformers and main 220 kV switchgear for this station.

* * *

In order to provide an improved delivery service for their customers in the Manchester area, **British Ermeto Corporation Ltd.,** and their associate Company, **Simplifix Couplings Limited,** both members of the Alenco Group, are to open a Depot on October 2nd, 1961, centrally situated in Blackett Street, Manchester, off Fairfield Street (Tel. No. Ardwick 4558). Stocks of Ermeto and Simplifix standard couplings, valves, hose and tube will be available.

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Keith Blackman Limited, Tottenham, N.17, manufacturers of "Tornado" fan engineering and industrial gas equipment, have placed a further contract with Hale Construction Co. Ltd. for a new heavy fabrication shop and dust research laboratory. The contract is valued at £45,000 and is the second to be placed with Hale Construction Co. Ltd. as part of the Company's expansion programme. The first contract which is nearing completion, was valued at £25,000 and included two new buildings to house both finished goods and raw materials.

Crofts (Engineers) Limited, Power Transmission Engineers, Bradford, have extended their stockholding service to their London branch. Extensive modifications at 36/42, Tanner Street, Bermondsey, London, S.E.1 (Tel.: HOP 7751/4), have enabled Crofts to offer the largest and most comprehensive power transmission stockholding service in the country. Furthermore, an attractive showroom will display the wide range of stock products and a representative selection of the company's specialised products. Similar branches are already operating successfully in Manchester, Birmingham and Leeds. Immediate availability of power transmission equipment is the aim of the service and ranges to be held in stock include: universal mounting worm-reduction gears, flexible and rigid couplings, shaft-mounted gear units, collars and plummer blocks, variable speed pulleys, V-rope pulleys and drives, etc. The technical and estimating service, a feature of all branches of Crofts (Engineers) Limited for many years, is being further augmented at these new offices under the management of the London Director, **Mr. H. W. Cameron.**

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A new division, to handle the design, construction and installation of electrical and mechanical precipitators, is announced by **Joy-Sullivan Limited.** This move is the result of the merging, in 1959, of Western Precipitation Corp. of Los Angeles with Joy Manufacturing Company of Pittsburgh, parent company of Joy-Sullivan Limited. Chiefly concerned with equipment for the control and recovery of particulate matter in industrial gases, the range of plant to be offered will include precipitators—of both electrical and mechanical types—filters, scrubbers, and certain processing and heating equipment. The products have wide applications in the field of power generation, cement manufacturing, and in the chemical, gas, iron and steel, and metallurgical industries. General Manager of the new division is **Mr. Kenneth H. Cree,** who comes to Britain with over 25 years' experience of Western Precipitation operations in New York and other U.S. cities. A sales office for Western Precipitation Division of Joy-Sullivan Limited has been established at 7, Harley Street, London, W.1. Telephone: Langham 7711, and design and construction will be carried out at Greenock, Scotland.

* * *

Electrical equipment valued at £45,000 has been ordered from the Motor and Control Gear Division of **Associated Electrical Industries Limited** by Stewarts & Lloyds Limited, Corby. The equipment is required for the modernisation of a continuous weld mill to increase output of 1¼ in. steel tubing to 750 ft./min. or 4 in. tubing to 320 ft./min.

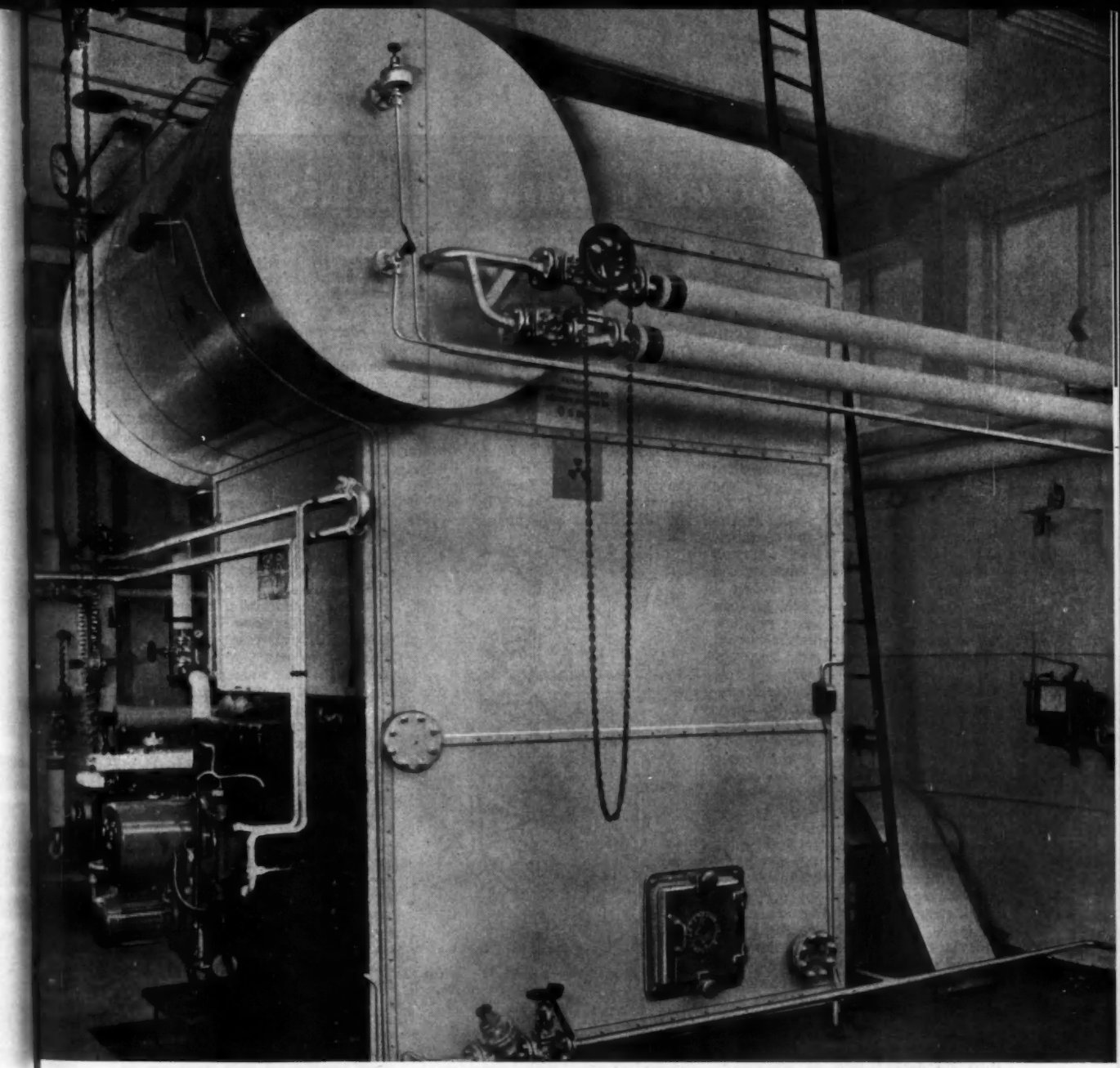
The first issue of a new stock list, which will be produced at regular intervals, is published this month by the Industrial Plant Department of **Thos. W. Ward Limited.** It is a 16-page booklet, fully illustrated, listing current holdings of boilers, tanks, pipes, and tubes, air-receivers, valves, etc., and it also gives details of the department's activities in specialised fabrication. Together with a general brochure—"Industrial Plant," published in January of this year—this stock list gives a good general picture of the service of Industrial Plant Department, which has over 70 years' experience in this field. It is intended to send the issues, as published, to all on a specialised list, but the department will be pleased to add the name of any interested firm or potential customer.

* * *

The manufacture, types and applications of Permbrite welded stainless-steel tubes, together with some cogent reasons for their use, form the subject of a 12-page illustrated booklet just published by **Rollo-Hardy & Co. Ltd.,** a member of the Compoflex Group of companies. As well as lists of applications, including examples from such firms as I.C.I. and ranging from heat-exchanger tubes to bus seat frames, the booklet gives details of the four types of stainless-steel used in the manufacture of Permbrite tube. Tables of the alloy composition, together with maximum pressures and weight per foot for a range of outside diameters and wall thicknesses are also given. Copies of the booklet may be obtained from Rollo-Hardy & Co. Ltd. at Paddockhall Road, Haywards Heath, Sussex.

HEIGHT AND DESIGN OF NEW CHIMNEYS

The Air Pollution Panel of the **Federation of British Industries** at its meeting on November 11th, 1958, appointed a Working Party to make recommendations on the height of new chimneys with particular reference to Section 10 of the Clean Air Act. The Working Party's main recommendation, contained in a handbook which was recently published, refer to industrial boiler plants with an output of 5,000-33,000 lb./hr. of steam at maximum continuous rating. Recommendations are also made in respect of larger plants up to an aggregate steam capacity of 450,000 lb./hr. None of the recommendations refer to washed gas effluents. It is also recommended that an F.B.I. Working Party should make a survey early in 1963, of the conditions around new chimneys built to these recommendations in order to check whether any modifications to the proposals are desirable. Copies of the handbook—**Height and Design of New Chimneys**—are obtainable from F.B.I. Print and Publications, 21, Tothill Street, London, S.W.1, price 4s. post free (excluding air mail).



THE REDFYRE CORNER TUBE BOILER
for High Pressure Hot Water and Steam

For the tallest buildings, for hospitals, factories, in fact any building requiring high-pressure steam or hot-water heating, the Redfyre Corner Tube Boiler is the *perfectly* right choice.

NOTE THE ADVANTAGES

- **Ideal and safe due to its natural circulation system**
- No water hammer or thermal shocks
- Pressure up to 1,000 lb./p.s.i.
- Robust. The boiler tubes, down-comers, etc. form a strong, welded, cage-like structure
- **Quick steam raising**
- High space utilisation
- Low power costs
- Low draught loss

FULL DETAILS OBTAINABLE FROM Newton Chambers & Co. Ltd., Engineering Division, Thorncliffe, Sheffield.

Newton Chambers

Latest Power Plant Patents

These extracts from British Patent Specifications are reproduced by permission of The Controller of H.M. Stationery Office. (Complete British Specifications can be obtained from the Patent Office, 26, Southampton Buildings, London, W.C.2. Price 3s. 6d. each, both inland and abroad.)

Dust separators

The primary object of this invention is to provide a dust separator which utilises the forces of centrifugation washing and inertia to produce a high extraction efficiency with a low resistance to gas flow and wherein the ratio of the volume of treated gas to the size of the separator is high. In operation the dusty gas passing through the tangential inlet to the cyclone chamber enters in a swirling movement whereby the coarser particles are removed by centrifugal force and settle at the bottom of the liquid in the chamber. The liquid level is so adjusted relatively to the lower edge of the gas outlet duct, that there is only a narrow gap through which gas can pass and the swirling gases produce a fine spray of liquid which is carried into the outlet duct. Any drops of liquid too large to be carried along with the gas stream fall into a catchment pipe. The mixture of dusty gases and fine spray pass at a progressively increasing velocity to the agglomerating section of the outlet duct and due to the reduced cross-sectional area at this zone the velocity is high and the gases are subjected to a high degree of turbulence which causes the particles of dust and liquid to agglomerate into larger closely bonded particles of dilute slurry. The rotary movement of the gases passing up the outlet duct is assisted by vanes, and the rotating gases pass into the divergent section of the duct beyond the high-velocity section. In this divergent section, the velocity of the gases gradually decreases and the agglomerated particles pass by centrifugal force to the periphery of the duct. The gases and particles are then discharged into an expansion chamber where the particles are extracted by a combination of centrifugal and inertia forces. The particles in the form of a dilute slurry are returned through to a container or to a settling-tank or to drain. *British Patent No. 870,812 issued to Dust Control Processes Limited, Darlington, County Durham. Complete specification published June 21st, 1961.*

Forming apertures in the walls of pressure vessels

This invention relates to a method of forming apertures in the walls of pressure-vessels and to tools for carrying out the method. The invention is concerned in particular with the formation of apertures in the pressure-vessels of gas-cooled, graphite-moderated nuclear reactors. The pressure-vessel of a gas-cooled, graphite-moderated nuclear reactor is necessarily of large diameter and of considerable wall thickness, and when the control rods and fuel elements are inserted and withdrawn by way of apertures in its top, the upper part

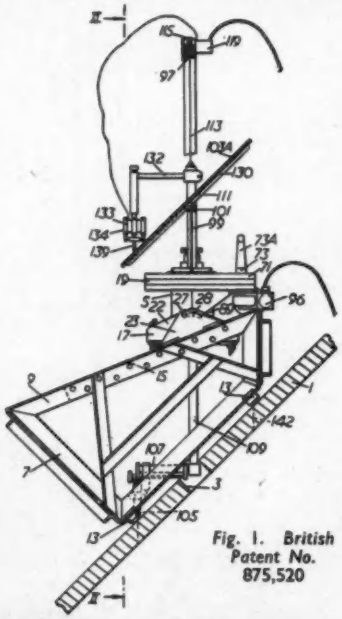


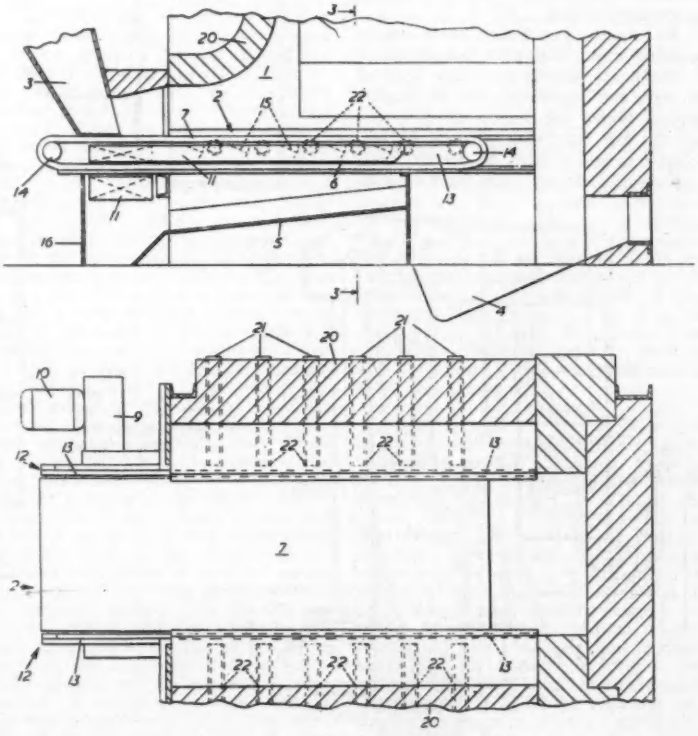
Fig. 1. *British Patent No.* 875,520

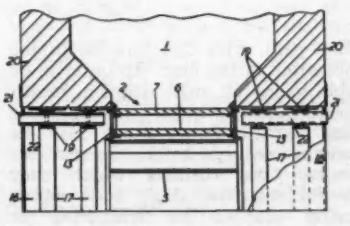
of the vessel must, during manufacture be formed with a considerable number of apertures of correct size and shape and accurately positioned in relation to the intended position of the core and the channels in the moderator for the accommodation of the fuel elements and control rods. When, as is advantageous, the vessel is of spherical shape, some of the apertures must be formed with vertical axes at parts of the vessel wall steeply inclined to the horizontal so that the formation of apertures of correct size, shape and position is rendered more difficult. A method according to this invention of cutting an accurately positioned aperture in the wall of a pressure-vessel of large size includes forming a pilot hole through the wall in such a position as to lie completely within the required aperture. On the pressure-vessel at one side of the wall and adjacent the desired aperture, a main support or frame is mounted for the body or head of a rotatable flame cutting tool. The pilot hole is utilised to permit accurate observation of the position of the axis of rotation of the cutting tool in relation to a point on the opposite side of the wall to the frame. The head of the cutting tool is adjusted in relation to the support to achieve a desired relation of the axis to the point. The head being secured in adjusted position and operation of the tool being effected to remove a substantially circular or oval plate of metal from the wall by flame cutting operation. In Fig. 1 the numeral (1) denotes a small part of the spherical shell of a gas-cooled, graphite moderated nuclear reactor. This shell is 3 in. thick and the diameter of the spherical shell is of the order of 135 ft. Within the shell is provided a metal grid (not shown) which in due course will support a graphite core of the reactor having vertical channels or passages for the reception of fuel elements and the flow of coolant gas. During the construction of the reactor it is necessary to form in the spherical shell a number of apertures each very accurately positioned so as to have its axis coincident with a vertical line drawn through some given point of the grid. This accurate positioning is rendered difficult by the very large size of the sphere which makes it difficult to locate by measurements made outside the sphere the exact location for such apertures, and by the possibility that the grid may be somewhat displaced from its intended position in the sphere. Working from the inside of the sphere, and using for example a light-beam projection method, it is possible to locate and then mark a starting point on the inside of the sphere which is vertically above the desired point on the grid to within an accuracy of one or two inches. A pilot aperture (3) of 6 in. dia. is then cut out of the spherical shell using the starting point as the aperture centre. A flame-cutting operation is used and

for ease in the cutting operation the axis of the pilot wall aperture is made normal to the vessel wall. The flame cutting tool is then applied to the outside of the spherical shell. The tool includes a main support or frame (7) having two parallel trapezoidal side members (9) braced together in spaced relationship by cross-pieces (11), the side members and the bracing pieces suitably welded together. The main frame (7) is provided with four feet (13) which, when the frame is suitably positioned relative to the aperture (3), are secured by welds to the outside of the shell. The upper angle-pieces of the two side members (9) are provided with parallel rails (15) in the form of mild-steel angle-pieces which are disposed inwardly of the side members with a side of one angle-piece coplanar with a side of the second angle-piece. Mounted on the rails (15) through the intermediacy of an intermediate support (17) is a cutting tool head or body (19). *British Patent No. 875,520 issued to Babcock & Wilcox Ltd. Complete specification published August 23rd, 1961.*

Mechanical stoking installation

This invention relates to mechanical stoking installations or settings for boilers, drying plants, kilns and suchlike, whereby solid fuel such as coal or coke is mechanically fed or stoked to the furnace or combustion chamber. Referring to Figs. 2, 3 and 4 the complete installation for a water-tube boiler comprises the usual furnace or combustion chamber (1) of firebrick or like refractory material, to which coal or similar fuel is fed by stoking mechanism which may consist of an endless conveyor-chain or chain-grate indicated at (2). In such installations it is usual to provide a coal-feed hopper (3) at one end of the chain-grate (2) and an ash pit (4) below the other end of it together with a riddlings tray (5) or similar receptacle underneath the return portion (6) of the chain. The installation may operate on a natural-draught or a forced-draught usually the latter provided by a fan or blower (9) power driven by a suitable motor (10), the forced draught being directed by ducting (11) under the operative run (7) of the chain-grate. The chain-grate (2) is supported by a chassis frame (12) comprising mainly side-members (13) which carry bearings for sprockets (14) or the like carrying the chain. The frame may also provide a guide-way for the operative run (7) of the chain, together with draught duct outlet means (15) under the operative run (7). For the purposes of this invention, enclosing structure is provided about the supporting members (13), and other parts of the stoking mechanism or chain-grate (2), this may either consist of the furnace brickwork commencing at ground level or preferably as shown may comprise panels or plates (16) (Fig. 4) secured about a supporting sub-structure such as rolled-steel columns (17) and joists (19) for the furnace brickwork (20) which latter may then commence substantially at the level of the chain-grate (2). If desired a combination of brickwork and panelling may be employed. Some or all of the panels (16) are desirably removable or openable as doors for gaining access to the stoking mechanism during periods of overhaul, whilst during periods of use the panelling imparts a neat exterior appearance to the installation. In accordance with this invention, the enclosing structure of brickwork and/or panelling (16) is provided with one or more air inlets (21) either in the form of openings or as shown in the form of suitable lengths of open ended pipe (22) or the like. The arrangement is such that the inlet openings and/or pipes (22) are so disposed that incoming cooled air from the exterior is directed to impinge upon the supporting members (12) and other parts of the stoking mechanism, the concentrated air flow so provided serving to cool such members or parts. As shown, the inlet openings or pipes (22) may lie in substantially the same horizontal plane as the chassis frame or like supporting structure (12) of the stoking mechanism, and where the inlets take the form of openings in panels of plates (16), they may consist of louvred slots. If desired, deflectors, vanes or the like may be provided within the enclosing structure between the inlets (21) and chassis frame (12) to further direct the incoming air in the required direction or directions. Regardless of the form of the inlets (21) provision



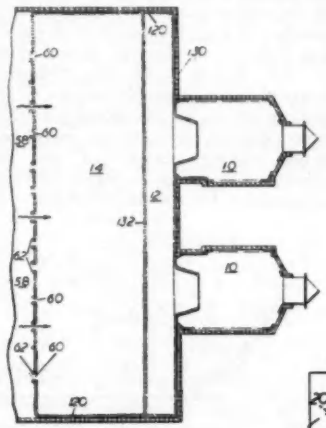


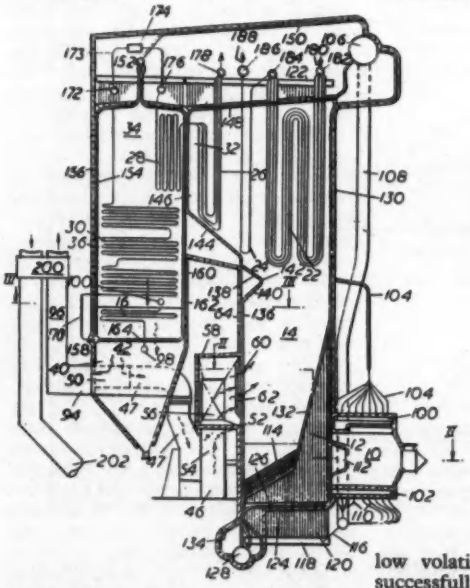
Figs. 2 (top), 3 (centre), and 4 (right). British Patent No. 875,740

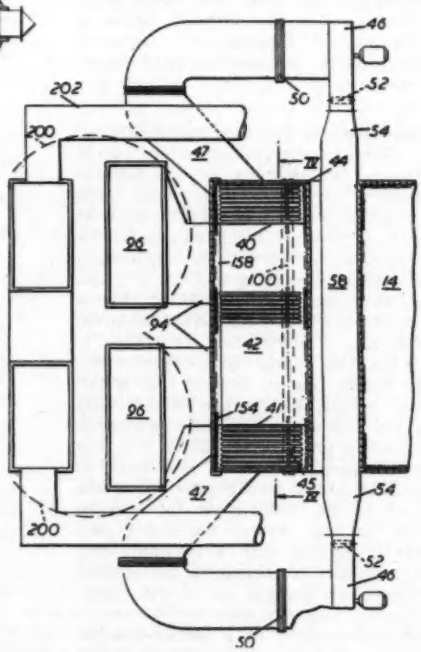
may be made for controlling or variably adjusting their effective openings in order to regulate or set the rate of incoming air flow or draught to suit working conditions. Air may be drawn in through the inlets (21) by the natural or forced-draught to the furnace although if desired and where a forced-draught is employed the fan or blower may supply the air to the inlets (21). By such cooling, the tendency of the supporting members (13) and other parts to burn or distort under the otherwise constant heat of the furnace is reduced with consequent increased serviceable life of the stoking mechanism, and reduced likelihood of failure of the latter under operating conditions. *British Patent No.* 875,740 *issued to Bennis Combustion Ltd. Complete specification published August* 23rd, 1961.

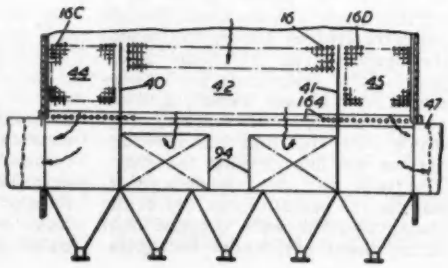
Steam generator with flue-gas recirculation

In steam generating and superheating units, slag particles entrained in the gases leaving a furnace adapted to burn ash-containing fuel at temperatures above the fusion temperature of the ash may slag, that is to say, adhere to and solidify on certain heat-exchange surfaces in the furnace gas-flow path, with deterioration in the operation of the unit. In order to be able to inhibit such slagging, means have been provided whereby the slag particle temperatures may be suitably reduced before the particles contact the surfaces which they would otherwise slag; such means being adapted for tempering or moderating the furnace gas temperatures by admixing with the high temperature furnace gas stream, a stream of furnace gases which have already been cooled by passage over some of the heat-exchange surfaces of the unit. Hitherto, the combustion of low volatile solid fuel, such as char and low volatile coal, has proved to be difficult without high carbon losses and difficulty in the slagging of heat-exchange surfaces. The inventors have found that char and low volatile coals can be successfully and efficiently burnt by the use of highly preheated combustion air, for example in a cyclone furnace. In a unit with cyclone furnaces and division of the furnace gases passing through the economiser into two portions, one portion destined for recirculation as tempering gases and the other portion destined for preheating combustion air in the air-heater, and with suitable allocation of the economiser surfaces to the respective passages in which the two furnace gas portions flow, low volatile coals and char can be successfully and efficiently burned, without high carbon losses, and without difficulties due to slag depositions, using combustion air at a high temperature in excess of 600 deg. F., preferably over 700 deg. F. and tempering gases at a temperature considerably, at least 100 deg. F., lower and with effective utilisation in the various heat exchangers of the heat in the furnace gases. Referring to Figs. 5-8, the steam generating, superheating and reheating unit has a furnace comprising two cyclone furnace chambers (10) and includes a secondary combustion chamber (12) into which heating gases are discharged by the cyclone furnace chambers, a radia-









Figs. 5 (left), 6 (above), 7 (right) and 8 (bottom right). British Patent No. 875,726

tion chamber (14) the lower end of which is in communication with the secondary combustion chamber (12), a gas-pass (32) leading rearwards from the upper end of the radiation chamber (14) to a gas-turning space (34), and a downflow gas-pass (36) below the gas-turning space (34). Heat-exchange means arranged in the gas-flow for the transfer of heat to the working fluid, include a reheater section (22) comprising tube platens parallel to the gas-flow in the upper part of the radiation chamber (14), a reheater section (24) arranged in the gas-pass (32), a superheater section(26) located in the gas-pass (32), a superheater section (28) arranged in the gas-turning space (34), a superheater section (30) arranged in the downflow gas-pass (36), and economiser sections (16, 16C and 16D) located below the superheater section (30). Like the secondary combustion chamber (12) and the radiation chamber (14), each cyclone furnace has walls including steam-generating tubes connected into the water circulation system of the unit. From each cyclone furnace, high temperature gases generated therein flow through a throat (112) into the secondary combustion chamber (12) and the gas-flow continues thence upwardly between horizontally spaced screen platens (114) into the lower part of the radiation chamber (14). Since the function of the tempering gases is to moderate suitably the temperature of the heating gases contacting the heat-exchange sections (22, 24 and 26) the maximum flow of tempering gases will be required at maximum fuel input to the cyclone furnaces. As the fuel burning rate is reduced in the unit, smaller flow rates of tempering gases will be sufficient to effect the desired temperature moderation, and the tempering gas-flow rate should be reduced accordingly. The tempering gas-flow rate may be adjusted, manually or automatically, by reference to the gas temperature taken in the vicinity of the reheater section (22). In an installation constructed as described and illustrated, the flow of tempering gases to the furnace (14) will be brought to zero when the fuel input falls from 100 per cent. to from 60 to 70 per cent. of maximum input, depending upon the operating conditions of the particular installation. Thus, with tempering gas flow utilised as described, the flow of gases through the gas pass sections (44 and 45) need not be proportional to the total flow of heating gases throughout the gas pass (36). To control the rate of tempering gas flow to the radiation chamber (14), the duct (54) leading from the fans (46) is provided with dampers (52). *British Patent No.* 875,726 *issued to Babcock & Wilcox Ltd. Complete specification published August* 23*rd*, 1961.

MEASUREMENT OF SMOKE EMISSION FROM INDUSTRIAL BOILERS

The British Standards Committee which have been investigating the extent to which smoke from industrial boilers can be reduced by good practice have now published their second report. The report, covering coal-fired shell-type boilers with various types of mechanical stokers, is published as Part Two of the British Standard on **Measurements of Smoke Emission** (B.S. 2978). It is unlikely that further reports, other than addenda to those already published, will be issued, as the majority of other plant in general use comes under the supervision of Government inspectors. This report will be of value, as was the earlier document, to factory management, and to local authorities, in helping them to achieve a good standard of smoke control and compliance with the law under the terms of the Clean Air Act. To obtain the material on which this report is based, the B.S.I. Committee carried out tests on eight shell-type boilers of modern design, known to be well-operated, in various industrial establishments. Detailed records were kept of smoke emission from each of these plants over periods of from three to eight weeks. A résumé of results for each of the boilers is given in the form of a table, with notes on the frequency with which various associated operations were performed and the level of smoke emission during such operations. The final conclusion is that "dark smoke from well-designed and correctly operated shell-type boilers with mechanical firing equipment of the types tested should not exceed eight minutes in any period of eight hours." A useful section at the end of the report lists factors influencing smokeless combustion in shell-type boilers fitted with mechanical stokers. Copies of B.S. 2978, Part Two, may be obtained from the British Standards Institution, Sales Branch, 2, Park Street, London, W.1. Price 7s. 6d. (postage is charged extra to non-subscribers).

More than 600,000 ft. of welded finned-tubing made by a new process is to be supplied by the **Extended Surface Tube Co. Ltd.,** Birmingham, for use in the boilers at Dungeness Nuclear Power Station. The company is jointly owned by Imperial Chemical Industries Limited, and Stewarts and Lloyds Limited, and the finning machines used for the order were designed and manufactured by Stewarts and Lloyds at their Corby works. In the new process, using welding-current generators among the most powerful of their type, cold rolled strip is welded to the tube as it is helically wound on to form the fin. As a result of strict control, a weld bead is produced which is small and consistent in quality and allows more fins per inch. Up to seven fins per inch are accepted as standard, probably the highest number ever produced in welded fin tube. The process is claimed to give good physical properties and allows tight radius bends. The size range of the tubes produced will complement the company's Integron finned-tube which is made by a rotary extrusion process and of which more than two million feet has been used in the boilers of the Bradwell and Berkeley nuclear power stations and in the Tokai-Mura Japanese nuclear power station. The fact that the tube is made in the Extended Surface Tube Company's new factory at Corby, adjoining the integrated steel and tube works of the parent company, makes possible a chain of control that is probably unique for this type of product. Control can be exercised from the raw material stage (the actual mining of the ore) to the finished tube. An interesitng feature of the Dungeness order is that some of the tubes for high-pressure duty will be supplied in 27 ton minimum tensile steel to B.S. 3059/13 and it is believed that this is the first time that this material has been supplied in the form of welded fin-tube. The low-pressure tubes will be made from 20-ton minimum tensile material to B.S. 3059/3. All are electric resistance weld tubes.

Associated Electrical Industries Limited has recently issued a new publication—"The AEI Arc Welding Guide"—which replaces previous Metrovick Electrode Guides. In addition to the latest data on the wide range of AEI welding electrodes, this enlarged booklet contains a considerable amount of technical information on welding, providing a comprehensive guide for the welding fabricator. Included in the new sections are a complete list of British Standard Specifications relating to welding processes and applications, notes on the care of electrodes, and a brief list of AEI arc-welding plant. Copies of this publication (number 1891-71) may be obtained free on request from Associated Electrical Industries Limited, Heating and Welding Department, Trafford Park, Manchester 17.

* * *

A special high-lift electric hoist has been ordered by the Central Electricity Generating Board (Southern Projects Group) for installation at Northfleet power station, Kent. The hoist, of 5-tons capacity, is being supplied by **Matterson Limited,** Rochdale, who are specialists in the design and manufacture of mechanical handling equipment. The problem which Matterson have had to solve at Northfleet is one of height; the forced-draught fans are located on the fourth floor of the building, and arrangements had to be made so that in the (somewhat remote) event of a fan-motor burning out, it could be removed and lowered to basement level for repair and replacement. The total lift will be 119 ft., and Matterson have been able to achieve this with one of their standard "Type-801" hoist-blocks, which is normally arranged for a lift of 10 tons through 64 ft. The "Type-801," of 22½ h.p. capacity, is available, like all Matterson hoists, with positive creeping speeds. Since the hoist-block itself weighs nearly 3 tons, erection will present its own problems, but Matterson expect the hoist to be in operation by November of this year.

NOTES *Personal* AND *Industrial*

The United Kingdom Atomic Energy Authority has agreed to release **Mr. P. T. Fletcher,** B.Sc.(Eng.), M.I.Mech.E., M.Inst.C.E., M.I.E.E. (previously deputy managing director, Development and Engineering Group at Risley and, since April, special adviser to the member for Reactors), to take up the appointment, as from October 1st, 1961, of director, responsible to the Board of the United Power Co. Ltd., for Construction and Supply. United Power Co. Ltd. is a company recently formed to unite the nuclear engineering activities of Atomic Power Constructions Limited and the G.E.C. and Simon-Carves Atomic Energy Group.

* * *

Dr. D. H. Sharp has been appointed director (technical) of the Federation of British Industries as from November 1st, 1961. He will take up the appointment on the retirement of the present technical director, **Major-General A. J. H. Dove,** who is leaving the Federation at his own request at the end of October, in order to devote more time to voluntary work. At present Dr. Sharp is assistant to one of the managing directors of Fisons Ltd.

* * *

Mr. F. Winston Reynolds, founder of Winston Electronics Ltd., Shepperton, Middlesex, has relinquished his duties as chairman and managing director of the Company, and will now devote the whole of his time to the exploitation of their new range of fully transistorised Loudspeaking Telephones. **Mr. W. Allen Bridges** is now chairman and managing director.

* * *

Mr. L. C. Lawson and **Dr. R. Gage** have been appointed to the board of Cape Asbestos Co. Ltd.

* * *

Mr. G. D. Saul has been appointed chief inspector of The United Steel Companies' Steel Peech and Tozer branch. He succeeds **Mr. W. M. Gladwin,** who has retired.

* * *

Mr. J. R. Beard, C.B.E., M.Sc., M.Inst.C.E., Hon. M.I.E.E., Fellow A.I.E.E., has announced his intention to retire at the end of this year from the position of senior partner of Merz & McLellan; he has agreed to continue his association with the firm as a consultant. **Mr. Alan E. Powell,** B.Sc., M.Inst.C.E., M.I.Mech.E., will act as senior partner as from January 1st next.

* * *

Mr. H. A. Longden, chairman of the West Midlands Division of the National Coal Board, has left the services of the Board after a lifetime's work in the British coal industry to take up the post of deputy chairman and chief executive of the Cementation Co. Ltd.

* * *

Mr. G. J. Robinson has been appointed a director of Head Wrightson Export Company.

The Minister of Power has reappointed **Sir William Holford,** F.R.I.B.A., M.T.P.I., as a part-time member of the Central Electricity Generating Board.

* * *

Two new welding engineers have joined Suffolk Iron Foundry (1920) Limited as area technical representatives. They are **Mr. H. Johnson,** technical representative for Lancashire and the North West Coast, and **Mr. H. B. Travis,** Yorkshire and North East Coast technical representative.

* * *

Mr. J. H. R. Hill, M.I.E.E., at present a technical officer in the Chief Engineer's Department of the London Electricity Board, has been appointed assistant chief engineer (operations) in succession to Mr. A. Hart, M.I.E.E., who will be retiring from the Board's service on October 6th.

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Mr. A. Paterson, B.Sc., A.R.T.C. (Glasgow), M.I.P.E., has been appointed works manager, Trafford Park Works, A.E.I. (Manchester) Ltd., and **Mr. A. J. R. Veale,** Assoc. M.C.T., A.M.I.Mech.E., M.I.P.E., has been appointed assistant works manager, with special responsibilities for the manufacturing services department.

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Mr. Richard P. E. Tabb has been appointed deputy director of engineering of The English Electric Co. Ltd. The directorate is responsible for the engineering policy for the whole range of the company's products (other than those of English Electric Aviation), and Mr. Tabb will be mainly concerned with the company's technical development programmes.

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Associated Electrical Industries Ltd. has appointed a Director of Research. He is **Mr. L. J. Davies,** who was director of Research of A.E.I. (Rugby) Ltd. This appointment is aimed at ensuring a coherent research effort by the Company and making the most effective use of the resources and scientific ability in its various laboratories. Mr. Davies becomes responsible for the direct supervision of the four A.E.I. Research establishments at Aldermaston, Harlow, Manchester and Rugby. He reports to the A.E.I. Board through Sir Cecil Dannatt, the vice-chairman, and now becomes a non-executive director of A.E.I. (Rugby) Ltd. Dr. J. E. Stanworth becomes the new Director of Research for A.E.I. (Rugby) Ltd. so that the directors of the A.E.I. Research Laboratories are as follows:—Aldermaston—**Dr. T. E. Allibone**; Manchester—**Dr. J. M. Dodds**; Harlow—**Dr. M. E. Haine**; and Rugby—**Dr. J. E. Stanworth.**

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Copes Regulators Limited have moved from their old address at 9, Southampton Place, London, W.C.1, to new offices at 307/8, High Holborn, W.C.1.

The following new appointments were announced recently by the Power Plant Division, The General Electric Co. Ltd., Erith, Kent, with responsibility to the divisional manager, **Mr. D. M. Smith,** M.I.E.E. The former sales manager, **Mr. F. L. Tombs,** A.M.I.E.E., has been appointed manager, engineering services, with executive responsibilities for sales, tendering, contracts and operational services departments and for site resident engineers. **Dr. D. Kalderon,** Ph.D. (Eng.), A.M.I.Mech.E., formerly chief development engineer, has been appointed deputy chief engineer. He joined G.E.C. in 1955 as turbine design engineer, in which capacity he was responsible, through Mr. J. M. Mitchell the chief engineer, for much of the large reheat machine development. **Mr. W. G. Rhodes,** M.I.Mar.E., A.M.Inst.F., is now manager, home sales and **Mr. D. C. Thorpe,** B.A. (Hons.), is now manager, overseas sales.

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Combustion Chemicals Limited, Elcot House, 33, Dorset Square, London, N.W.1, announce the formation of a subsidiary company, under the name of **Water Engineering Limited,** 33, Dorset Square, London, N.W.1. Water Engineering Limited will manufacture in this country under licence the range of water clarification and purification plant successfully marketed on the Continent by "Cie. D'epuration et de Traitement des Eaux," of Paris over the last few years.

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The Visco Engineering Co. Ltd., incorporated in 1921, has changed its name to **Visco Limited.** This company, which have been supplying, for the past 40 years, air filtration, fume removal, dust-collection, water-cooling and ventilating equipment to industry, will continue manufacturing these and other specialised equipment such as their recently-introduced, Visco Isokinetic Fume Sampling Apparatus (V.I.S.A.), at their factories in Stafford Road, Croydon, Surrey, and Port Causeway, Bromborough, Cheshire.

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A contract valued at approximately £200,000 for the design and supply of a coal preparation plant for Compania Carbonifera e Industrial de Lota in Chile, South America, has been won by **Simon-Carves Ltd.,** Cheadle Heath, Stockport, in face of world-wide competition. The plant will be capable of handling 4,400 tons of coal each two-shift day, and includes hand-cleaning for the large coal, Baum washing of two different qualities of coals of intermediate size, together with water clarification and coal handling equipment. The washing capacity is 260 tons per hour of 4-in. and 2-in. coals. Of the different quality coals, one is for metallurgical and the other for industrial use. This is the first contract for coal preparation plant that Simon-Carves has won in South America.